NUCLEAR SCIENCE ABSTRACTS

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ERRATA

NSA, Vol. 8, No. 20, p. Index-8. In Numerical Index of Reports, Report AECD-2595, NNES Div. VI, Vol. 2, Chap. 17, should be NNES Div. VI, Vol. 2, Chap. 16.

NSA, Vol. 8, No. 20, p. Index-9. In Numerical Index of Reports, Report UCRL-1815, availability information, should be Dep.; $0.60.

NSA, Vol. 8, No. 22, p. 825. In abstract 6795, Maynard Eicner should be Maynard Eicher.

GENERAL

468

ANALYTICAL INDEX OF CHEMICAL ENGINEERING PUBLICATIONS, PATENTS, AND REPORTS. CHEMICAL ENGINEERING REPORT NO. 10. Tennessee Valley Authority, Wilson Dam, Alabama, 1954. 192p. $0.55 (GPO). Compiled by E. L. Newman and L. D. Copeland.

This report catalogues, by subject, publications, patents, and internal reports covering a large part of TVA's chemical engineering activities since the beginning of TVA in 1933. A subject index is included. (auth)

ATOMIC BOMBS AND WARFARE

469

THE IMPACT OF NUCLEAR ENERGY ON SAFETY AND THE CITIZEN. Robert J. Hansen (Massachusetts Inst. of Tech., Cambridge). NUCLEAR ENGINEERING, PART III, Chem. Eng. Progr. Symposium Ser. No. 13, 210-15(1954).

ATOMIC POWER

470

BIGGER GOALS FOR NUCLEAR ENERGY. John J. Grebe and Alden W. Hanson (Dow Chemical Company, Midland, Michigan). NUCLEAR ENGINEERING, PART III, Chem. Eng. Progr. Symposium Ser. No. 13, 200-9(1954).

BIOLOGY AND MEDICINE

471

THE DEPENDENCE OF THE PROCESS OF METAMORPHOSIS OF AXOLOTLS ON FACTORS OF AGE, COLORING AND SEX. L. P. Lipchina. Translated from Zhur. Eksptl'. Biol. i Med. 13, 73-8(1929). 12p. (AEC-tr-1975)

472

EVIDENCE FOR RELATIONSHIP BETWEEN SODIUM (CHLORIDE) INTAKE AND HUMAN ESSENTIAL HYPERTENSION. L. K. Dahl and R. A. Love (Brookhaven National Lab., Upton, N. Y.). Arch. Internal Med. 94, 525-31(1954)

A group of 547 adults was classified as having low, average, or high NaCl intake at table. The incidence of hypertension among the three groups was studied. No hypertension was found among those 65 persons classified as having a low NaCl intake; there were 17 hypertensives among the 243 persons in the average-intake group; 24 of the 239 persons classed as having a high sodium intake had hypertension. As tested by the χ-square criterion, such a distribution would occur by chance in slightly less than 3% of cases. The hypothesis is produced that some minimum level of sodium intake must be exceeded for the development of essential hypertension but that, while necessary, sodium is not of itself sufficient for development of the disease. (auth)

473

MECHANISM OF HYDROLYSIS OF ADENOSINETRIPHOSPHATE CATALYZED BY PURIFIED MUSCLE PROTEINS. D. E. Koshland, Jr., Zelda Budenstein, and Arthur Kowalsky (Brookhaven National Lab., Upton, N. Y.). J. Biol. Chem. 211, 279-87(1954) Nov.

Adenosinetriphosphate was partially hydrolyzed in H_2O^{18} in the presence of purified rabbit muscle actomyosin. One atom of oxygen was introduced into each molecule of phosphate produced and no detectable O^{18} was found in either the ADP or unhydrolyzed ATP. No exchange of $KH_2P^{32}O_4$ with ATP, of H_2O^{18} with KH_2PO_4, H_2O^{18} with ATP, OR ADP^{32} with ATP was observed to be catalyzed by the muscle protein. The results are consistent with a displacement mechanism in which nucleophilic attack occurs on the terminal phosphorus atom and in which only a transient intermediate is formed. The implications for muscle action are discussed. (auth)

RADIATION EFFECTS

474

Food Research Inst.
A. STUDY OF THE EFFECT OF RADIATION ON STAPHYLOCOCCUS ENTEROTOXIN. M. J. Surgalla.
B. RADIATION STUDIES ON SURFACE RIPENED CHEESE. R. O. Wagenaar. REPORT NO. 4 (TERMINATION) COVERING PERIOD JUNE 18, 1952—SEPTEMBER 30, 1954. 26p. Contract AT(11-1)-231. (AECU-2957)

The effect of radiation on staphylococcus enterotoxin. Dosages of 800,000 rep Co^{60} γ radiation inactivated staphylococcus enterotoxin. Smaller doses were ineffective. Radiation studies on surface ripened cheese. The feasibility of using radiation in safeguarding vacuum-packed cheese spreads was investigated. Data are presented from 16 experiments on soft surface-ripened cheese samples inoculated with Clostridium botulinum spores and irradiated at various dosages of Co^{60} γ radiation. Results from experiments designed to study the effect of irradiation on the toxin-producing ability of spores showed this characteristic was unaltered by sub-lethal dosages. Data are included from studies of the effects of medium, atmosphere, and temperature on radioinactivation of Cl. botulinum toxin and spores in cheese. (C.H.)

475

Brookhaven National Lab.
GENETIC AND NON-GENETIC EFFECTS OF RADIATIONS IN NEUROSPORA. V. W. Woodward and C. M. Clark. Brookhaven National Lab. and Univ. of Delaware. [1954]. 9p. (BNL-2052)

Data are presented on the effect of x radiation on Neurospora from which it is concluded that changes are instigated in both the genetic and non genetic components of conidia. The relationship between mutation rate and conidial survival is examined and it is concluded the survival curve is a composite of at least two independent

events, conidial stimulation and inactivation. The implications of these findings are discussed briefly. (C.H.)

476

Brookhaven National Lab.
THE RELATIONSHIP BETWEEN CHROMOSOME FRAGMENTATION AND REJOINING IN TRILLIUM ERECTUM FOLLOWING THERMAL NEUTRON AND X-IRRADIATION. Eleanor E. Deschner. [1954?] 4p. (BNL-2063)

No consistent relationship has been found to exist between the rejoining capacity and degrees of sensitivity exhibited by chromosomes of Trillium erectum exposed to irradiation at various stages of microsporogenesis. Consideration of the data seems to indicate that the processes of breakage and reunion may be controlled by two independent mechanisms. An alternate possibility is that they are two processes whose relationship in time is obscured because they do not proceed at the same rate. In addition, it was found that not only were there large differences in radiosensitivity of various stages to chromosome breakage, but also stages similar in sensitivity to fragmentation differ with respect to the degree of rejoining which follows. (auth)

477

Naval Medical Research Inst., Bethesda
AN ANALYSIS OF THE EFFECTS OF TOTAL-BODY X-IRRADIATION ON THE BODY WEIGHT OF WHITE SWISS MICE. 1. THE WEIGHT AND MORTALITY OF MALE AND FEMALE MICE IN THE LETHAL X-RAY DOSE RANGE. William H. Chapman. Aug. 14, 1954. 15p. (NM-006 012.04.67)

The characteristic weight responses for 60- to 80-day-old male and female mice exposed to lethal doses of total-body x radiation have been demonstrated. The weight curves reflect the degree of radiation damage and exhibit different characteristics at different dose range levels. Male mice gained proportionately more weight than female mice exposed to x-ray doses of 740 r or less and lost proportionately more weight than the females, following x-ray doses in excess of 740 r. Male 28-day survivors of x-ray doses in the mid-lethal or high-lethal dose ranges showed the greatest weight loss at two weeks after irradiation (13.6 percent weight lost by 890 r survivors on the 12th postirradiation day). Female 28-day survivors of eqivalent x-ray doses sustained the greatest weight loss on the fourth postirradiation day (11.2 percent weight lost by 890 r suvivors on the fourth postirradiation day). The 28-day mortality of male mice was consistently greater than that of female mice exposed to the same respective doses within the LD_9 to LD_{100} mortality range. (auth)

478

Radiobiological Lab., Univ. of Texas
SOME EFFECTS OF A LETHAL DOSE OF X-RADIATION UPON RETENTION. STUDIES OF SHOCK AVOIDANCE MOTIVATION. (Project No. 21-3501-0003, Report No. 9). William H. Melching, Radiobiological Lab., Univ. of Texas and School of Aviation Medicine and Sylvan J. Kaplan, School of Aviation Medicine. Aug. 1954. 9p. (NP-5412)

Each of eight Macaca rhesus monkeys was trained to give an instrumental response under shock motivation. Four of the subjects were trained on two problems in a shuttle-box involving visual and auditory cues, and four were trained to select the correct alley in a maze on the basis of visual cues. Upon reaching criterion of mastery, subjects were exposed to 1,500 r of x radiation. Results indicated that

radiation had no deleterious effects upon the performance tested. The experiments demonstrated the feasibility of employing shock motivated devices in the behavior testing of irradiated monkeys. (auth)

479

School of Aviation Medicine
SOME EFFECTS OF A LETHAL DOSE OF X-RADIATION UPON RETENTION IN MONKEYS. (Project No. 21-3501-0003, Report No. 8). Sylvan J. Kaplan and Maurice Delit, School of Aviation Medicine and George Gentry and William H. Melching, Radiobiological Lab., Univ. of Texas and [School of Aviation Medicine]. Aug. 1954. 10p. (NP-5413)

The experiment was designed to investigate the performance of rhesus monkeys on a multiple discrimination task involving two orders and two groupings of stimuli, both before and after exposure to a lethal dose of x radiation. No statistically significant differences appeared in the .01 level as late as trial 11 of the 13 trials given. Moreover, the performance of each experimental subject was at or beyond the .01 level during the post-radiation period when all responses on all trials involved were combined. Principal behavioral deficits noted were increases in reaction times and failures to respond in the testing situation. (auth)

480

Air Force Radiation Lab., Univ. of Chicago
QUARTERLY PROGRESS REPORT NO. 13. Oct. 15, 1954. 136p. Contract AF33(038)-27353. (NP-5419)

Data are presented from studies of the effects of partial shielding on the 5-nucleotidase and adenosine triphosphatase activity of the hematopoietic tissues of irradiated rats and alteration of the adenosine triphosphatase activity of hematopoietic tissues by post-irradiation implantation of exogenous hematopoietic tissue; the influence of x irradiation on metabolism of hematopoietic tissues of rats; the biochemical and histopathological effects of high-level doses of total-body x radiation on various tissues in rats and modifications in these responses produced by increased environmental temperature; the design and construction of a controlled-atmosphere radiation exposure chamber for small animals; the effects of certain thiourea derivatives and 2,4-dinitrophenol on the mortality of irradiated mice; and the effects of total-body x irradiation on the metabolism of sulfanilamide and phenolic compounds by guinea pigs and rats. (For preceding period see NP-5266.) (C.H.)

481

Atomic Energy Project, Univ. of Rochester
STUDIES ON FLASH BURNS: FURTHER REPORT ON THE PROTECTIVE QUALITIES OF FABRICS, AS EXPRESSED BY A PROTECTIVE INDEX. George Mixter, Jr. Oct. 27, 1954. 19p. Contract W-7401-eng-49. (UR-354)

Data are presented which define the protection against thermal energy afforded to the skin of Chester White pigs by certain one-and-two layer fabric combinations. A dimensionless number, called the protective index, is proposed as a quantitative measure of this protection. It is defined as the ratio between the 2-plus median effective exposure under fabric and the 2-plus median effective exposure for bare skin at the same exposure time. For the systems studied this ratio varies from 1.38 to 11.1. (auth)

482

Naval Radiological Defense Lab.
EFFECT OF REPETITIVE EXPOSURE TO GAMMA RAYS

ON THE HEMATOPOIETIC SYSTEM OF THE RAT. S. J. Baum, D. J. Kimeldorf, and E. M. Jacobsen. Aug. 27, 1954. 22p. (USNRDL–TR–12)

Male rats were exposed one or more times to 75-r gamma radiation at seven day intervals. Hematological examinations after the last exposure indicated that the maximum changes were largely independent of the number of exposures and reflected mostly the effects of the last irradiation. These results are ascribed to the capacity of the hematopoietic system to recover during the seven day intervals. (auth)

483

INVERSE RELATIONSHIP BETWEEN THE WATER CONTENT OF SEEDS AND THEIR SENSITIVITY TO X-RAYS. Richard S. Caldecott (Brookhaven National Lab., Upton, N. Y.). Science 120, 809-10(1954) Nov. 12.

Seeds with water contents of 7,9,13,16, and 24% were subjected to doses of x radiation of 10,000, 20,000, 30,000, 40,000, and 50,000 r, and an inverse relationship was found between the water content of the seeds and their radiosensitivity as determined by seedling heights at 7 days. Significance of the findings is discussed briefly. (C.H.)

484

ORAL MANIFESTATIONS OF IONIZING RADIATION. II. EFFECT OF 200 KV. X-RAY ON RAT INCISOR TEETH WHEN ADMINISTERED LOCALLY TO THE HEAD IN THE 1,500R. DOSE RANGE. James A. English, Carl A. Schlack, and Friedrich Ellinger (Naval Medical Research Inst., Bethesda, Md.). J. Dental Research 33, 377-88(1954) June. (cf. NSA 6-2254)

Three littermate groups of a well-controlled colony of white rats were used in a radiation study involving a single dose of localized head x radiation to 21-day-old animals, with a maximum dose of 1,500 r. Striking changes were observed in the developing incisor teeth of irradiated animals sacrificed 100 days following treatment. Roentgenograms taken at forty-three days post-treatment revealed that all exposed animals already had a visible break in incisor tooth formation, located at the region which was forming at the time of exposure. The incisor teeth of sacrificed animals were separated into two segments: in the maxilla, the first segment was frequently lost at 100 days, leaving a stump-like tooth; in the mandible, the second-formed segment frequently grew lateral to the first, producing in effect an extra incisor tooth. As a result, many rats appeared to have four lower incisor teeth, whereas upper incisors were short or missing. In histologic section, it was seen that extreme damage had been done to the tooth-forming elements which were physiologically active at the time of exposure, as evidenced by stoppage of tooth formation. The tooth-germ was also damaged, but to a lesser degree, as exhibited by the flaws in tooth formation during the 100-day period following irradiation. Although random odontogenic elements were completely obliterated, there appeared to be a general recovery of tooth-forming tissues. (auth)

485

SKELETAL EFFECTS OF RADIO-IODINE INDUCED THYROID DEFICIENCY IN MICE AS INFLUENCED BY SEX, AGE, AND STRAIN. Ruth Silberberg and Martin Silberberg (Snodgras Lab. and Washington Univ. School Med., St. Louis, Mo.). Am. J. Anat. 95, 263-89(1954) Sept.

In male and female mice of strains DBA and C57BL, thyroid deficiency induced by radioactive iodine, I^{131}, retarded growth and development of the tibia. The underlying histogenetic mechanisms consisted of delayed growth and ossification of the epiphyseal cartilage and of marked inhibition of resorption of cartilage and bone. These changes, in particular the inhibition of resorption, were more prominent in females than in males and more pronounced in strain DBA than in strain C57BL. The skeletal response to thyroid deficiency decreased with advancing age at the time of administration of the isotope. The possible relationship of strain and sex differences to the genetic hormonal make-up is discussed. It is suggested that the sex difference in skeletal response to thyroid deficiency induced by I^{131} are primarily due to the action of estrogenic hormone in the female and that the strain differences are related to strain differences in thyroid activity of mice of the two strains investigated. In addition, the strain differences in the skeletal response of females to the thyroid deficiency seem to be determined by the amount or relative potency of the endogenous estrogenic hormone produced. (auth)

486

METABOLISM OF BENZOIC ACID IN NORMAL AND IRRADIATED RATS. Kurt Schreier, Kurt I. Altman, and Louis H. Hempelmann (Univ. of Rochester School of Medicine and Dentistry, N. Y.). Proc. Soc. Exptl. Biol. Med. 87, 61-3 (1954) Oct.

The isotope concentration of the urinary hippuric acid of starved irradiated or nonirradiated rats given benzoic acid-carboxyl-C^{14} is much less than the dilution expected from the conjugation of the injected labeled benzoic acid with inert carbon atoms of the glycyl residue. Evidence is presented that benzoic acid is a normally occurring metabolite in rats. The effect of x radiation on the ability of starved rats to conjugate benzoic acid-carboxyl-C^{14} has been tested, and no defect detected under the experimental conditions used. (auth)

487

WOUND HEALING AND MORTALITY AFTER TOTAL BODY EXPOSURE TO IONIZING RADIATION. Antolin Raventos (Army Medical Service Graduate School, Washington, D. C.). Proc. Soc. Exptl. Biol. Med. 87, 165-7(1954) Oct.

A standardized laparotomy wound was produced in mice following a whole-body x-ray dose of 500 r. The tensile strength of the healing wounds was compared on several post-operative days to wounds in unirradiated mice. In addition, 30 day mortality was determined for mice subjected to wounding, to irradiation, and to wounding plus irradiation. Irradiated animals showed a significant retardation of wound healing from the 6th through the 11th day after wounding, but not thereafter. Wounding did not alter post-irradiation mortality. (auth)

488

EFFECT OF TOTAL BODY X-IRRADIATION ON DESOXYRIBONUCLEASE ACTIVITY OF RAT SPLEEN. Vias M. Fellas, I. Meschan, Paul L. Day, and Carl D. Douglass (Univ. of Arkansas, Little Rock). Proc. Soc. Exptl. Biol. Med. 87, 231-3(1954) Oct.

The acid-active DNAase of rat spleen has been found to increase markedly after 500 r of total-body x irradiation. Such a change is not apparent in the neutral enzyme of liver or spleen. The maximum in activity of the elevated DNAase occurs 24 to 48 hours post-irradiation. Maximal response is elicited at a dose of 200 r. (auth)

489

EFFECT OF TOTAL BODY X-IRRADIATION ON SERUM ELECTROLYTE LEVELS AND ELECTROCARDIOGRAMS OF THE GOLDEN HAMSTER. George P. Fulton and Frederick N. Sudak (Boston Univ., Mass.). Am. J. Physiol. 179, 135-8(1954) Oct.

Disturbances in serum potassium and sodium concentration, electrocardiogram, and circulation in the cheek pouch were demonstrated in terminal hamsters following exposure to 1000 r total-body x radiation. (C. H.)

490

IONIZING RADIATIONS AND MUTATIONS. Juan De Dios Leal Luna. Bol. radiactividad (Madrid) 25, 66-78(1952-53). (In Spanish)

A general discussion is presented of the effects of ionizing radiation in producing mutations and the influence of such processes on evolution. (K.S.)

491

EFFECT OF IONIZING RADIATIONS IN THE VIRUS POLIOMYELITIS SK. G. Comba Ezquerra. Bol. radiactividad (Madrid) 25, 79-92(1952-53). (In Spanish)

492

PHYSILOGIC AND HISTOCHEMICAL CHANGES IN CONNECTIVE TISSUE OF RAT INDUCED BY TOTAL BODY IRRADIATION. A. C. Upton and W. D. Gude (Oak Ridge National Lab., Tenn.). Arch. Pathol. 58, 258-64(1954) Sept.

Evans blue injected intradermally in rats after wholebody x irradiation spreads more rapidly and more widely than in nonirradiated litter mates. The radiation-induced permeability of dermal connective tissue appears four to seven days after irradiation and persists for from two to three weeks, the period coinciding with that of increased vascular permeability and purpura. The heightened permeability of the dermis is associated with increased stainable acid polysaccharide in the ground substance of the dermis and panniculus, as indicated by the Hale stain, and with reduction in the number of mast cells in the dermis. (auth)

493

DESIGN OF A PORK-IRRADIATION FACILITY USING GAMMA RAYS TO BREAK THE TRICHINOSIS CYCLE. H. J. Gomberg, S. E. Gould, J. V. Nehemias, and L. E. Brownell (Univ. of Michigan, Ann Arbor). NUCLEAR ENGINEERING, PART III, Chem. Eng. Progr. Symposium Ser. No. 13, 89-104(1954)

The use of ionizing radiation to break the trichinosis cycle has been discussed previously . The technical feasibility has been well established; economic feasibility is thus the major outstanding problem. Presented here are the results of a cost study of a meat-processing plant designed to irradiate hog carcasses, using Cs^{137} or waste fission products as the radiation source. A radiation dose of 15,000 r will sterilize trichinae encysted within a hog carcass so that they cannot reproduce and cause infection. The irradiation level used in the cost study is 30,000 r to the surfaces of the carcass. Tests and calculations have shown that this radiation could produce a dose of 25,000 r at the center of a 14-in.-thick carcass, using techniques which minimize attenuation due to geometry. The thickest sections of carcasses (the hams) are rarely more than 10-in. thick. Flavor tests with ground pork show no detectable taste changes with doses up to 60,000 r. This radiation can also destroy microorganisms. The pasteurization achieved by 60,000 r increases the refrigerator shelf-life of the meat by approximately 100%; 30,000 r increases shelf-life by almost 30%. Pasteurization with gamma radiation will be discussed in more detail in a separate study covering this effect in a number of products. The plant design outlined in this paper was evolved. (auth)

494

IONIZING RADIATION CATARACTS. David Shoch and Irving Puntenney (Northwestern Univ. Medical School, Chicago, Ill.). Quart. Bull. Northwestern Univ. Med. School 28, 359-63(1954) Winter.

The investigations to date have shown that the ciliary body is injured only temporarily by ionizing radiation, and, although this temporary damage may play a part in the development of the radiation cataract, it is at best a minor factor. Therefore, it is concluded that the site of injury in radiation cataract is the lens itself. (auth)

495

THE EFFECTS OF X-RAYS ON THE RESPIRATORY METABOLISM OF EGGS AND EMBRYOS OF THE GRASSHOPPER CHORTOPHAGA VIRIDIFASCIATA. S. R. Tipton and G. S. St. Amand (Oak Ridge National Lab., Tenn. and Univ. of Tennessee, Knoxville). Physiol. Zool. 27, 311-17 (1954) Oct.

The oxygen consumption of Chortophaga eggs measured at 38°C in oxygen averaged 78.8 ± 3.3 mm³ oxygen per 100 eggs per hour and increased 28 per cent during a 4-hour period of respiratory determination. When measured at 38°C in air, the rate of oxygen consumption did not change during a 4-hour period. Winter embryos freed of yolk and placed in isotonic medium respired at a significantly lower rate than did spring and summer embryos treated in the same manner. The addition of glucose to the suspending medium had no effect on the respiration of embryos. Comparable rates were obtained with measurements of 40 embryos in Warburg flasks and of individual embryos in Gregg respirometers. X-ray doses of 10,000 r and above significantly reduced the oxygen consumption of 14-day Chortophaga eggs in the first hour after treatment. Doses of 3,500 r and above significantly reduced the respiration of embryos in the hour following irradiation. The reduction in respiration increased with larger doses of x rays. (auth)

RADIATION HAZARDS AND PROTECTION

496

VENTILATION OF URANIUM MINES. E. C. Tsivoglou and H. E. Ayer. Arch. Ind. Hyg. and Occupational Med. 10, 363-71(1954) Nov.

Theoretical expressions have been presented which predict the reductions in atmospheric concentrations of radon and each of its daughters to be expected as the result of ventilation of a restricted volume. This theory has been applied in an investigation of the effects of ventilation of a working section of a uranium mine, and the agreement between observed and predicted results was satisfactory. (auth)

RADIOTHERAPY

497

A 20 CURIE TELECOBALT UNIT. J. H. Mellink (Academic Hospital, Leiden, Holland). Acta Radiol. 42, 305-15(1954) Oct. (In English)

A description is given of the design and the mounting of a

home-made 20-curie telecobalt unit which can contain up to 100 curies Co[60]. Dose measurements have been performed in a masonite phantom for two applicators with small irradiation fields and source-skin distances of 25 and 15.5 cm, respectively; these agree satisfactorily with the values of the percentage depth dose predicted theoretically by Lamerton. From a provisional comparison of the measurements with those of several other investigators it may apparently be concluded that for small areas the 'F' factor (Mayneord and Lamerton) may be used for all depths and for all source-skin distances between about 15 cm and 100 cm without introducing any appreciable error. (auth)

498

RADIATION DOSIMETRY OF INTERNALLY ADMINISTERED BETA RAY EMITTERS: STATUS AND PROSPECTS. Leonidas D. Marinelli (Argonne National Lab., Lemont, Ill.). Radiology 63, 656-63(1954) Nov.

499

UPTAKE OF RADIOACTIVE IODINE IN THE THYROID OF PATIENTS WITH IMPAIRED LIVER FUNCTION. Richard Mueller, Charles C. Brausch, Eugene Z. Hirsch, Richard S. Benua, and Brown M. Dobyns (Western Reserve Univ. School of Medicine, Cleveland, Ohio). J. Clin. Endocrinol. and Metabolism 14, 1287-99(1954) Nov.

The I^{131} thyroidal uptake was 50 per cent or higher in 20 out of 50 patients with liver disease but no evidence of thyroid disease. Among the patients with liver disease, elevated I^{131} thyroidal uptakes were associated most frequently with spider angiomata, jaundice, and microscopic evidence of severe cellular damage of the liver. No correlation could be established between elevated I^{131} thyroidal uptakes and either the presence of ascites or the results of any single test for liver function. In spite of the elevated I^{131} uptakes by the thyroid in some patients with liver disease, there was no evidence for increased production of thyroid hormone, either by clinical findings or by laboratory determinations of the basal metabolic rate, the serum protein-bound iodine level, or the height of thyroid cells. Although abnormal kidney function may be present in patients with cirrhosis, the normal urinary excretion of radioiodine found in sample patients in this series indicated that renal disturbance at the time of the tests was not the cause of the elevated I^{131} thyroidal uptakes. (auth)

500

QUANTITATIVE MEASUREMENTS OF RADIOIODINE RETENTION IN THYROID CARCINOMA. E. Eric Pochin, R. M. Cunningham, and Gwen Hilton (Univ. Coll. Hospital Medical School, London, England). J. Clin. Endocrinol. and Metabolism 14, 1300-8(1954) Nov.

A method is described for measuring the uptake of I^{131} in functioning carcinomas of the thyroid. The method was used in measurements of the percentage of each dose concentrated in recognizable tumor sites. In patients with clearly functioning tumors, examined after thyroid ablation, the total tumor uptake was found to fall progressively from dose to dose, and the uptake of any one dose was usually between 30 and 80% of that of the previous therapeutic dose. Possible explanations are discussed. (C.H.)

TOXICOLOGY STUDIES

501

Hanford Works
GASTRO-INTESTINAL ABSORPTION OF PLUTONIUM.

2. EFFECT OF PLUTONIUM CONCENTRATION IN SOLUTION FED. Joseph Katz, Maurice H. Weeks, and Roy C. Thompson. Jan. 4, 1954. 9p. Contract W-31-109-Eng-52. (HW-30220)

The concentration of plutonium in the solution fed had no effect on the gastrointestinal absorption of plutonium over the range from 10^{-5} μg/ml to 1 μg/ml. The average absorption was 0.0028% of the amount fed, with 0.0025% of the amount fed being deposited in the skeleton. (auth)

502

TOXICITY OF THE OXIDES OF NITROGEN. I. INTRODUCTION AND APPARATUS. Edward Le B. Gray, Stanley B. Goldberg, and Francis M. Patton (Army Chemical Center, Md.). Arch. Ind. Hyg. and Occupational Med. 10, 409-17(1954) Nov.

A new method for the dispersion of red fuming nitric acid (RFNA) has been devised, making it possible to supply nitrogen dioxide vapors from RFNA at a constant and reproducible rate. In principle, the method consists of passing a slow stream of liquid RFNA through a current of air. In this way a fresh sample of liquid is always presented to the air stream, and each component is evaporated at a constant rate depending upon the individual vapor pressures. Variations in the rate of vaporization incident to the resistance caused by the effluent stream are eliminated by simply removing the stabilizer and flowmeter from the effluent stream of air. It is suggested that this technique is applicable to the vaporization of other materials possessing two or more components whose vapor pressures are significantly different. A hood has been described which encloses the chambers and dispersing equipment and which is so designed that it not only does not hamper chamber manipulations, visibility, and accessibility but also provides convenient mounting space for such accessory equipment as might be needed in the experiment. All materials required for the apparatus are readily obtainable. (auth)

503

TOXICITY OF THE OXIDES OF NITROGEN. II. ACUTE INHALATION TOXICITY OF NITROGEN DIOXIDE, RED FUMING NITRIC ACID, AND WHITE FUMING NITRIC ACID. Edward Le B. Gray, Francis M. Patton, Stanley B. Goldberg, and Ezra Kaplan (Army Chemical Center, Md.). Arch. Ind. Hyg. and Occupational Med. 10, 418-22(1954) Nov.

Rats were exposed to the vapors of NO_2, red fuming nitric acid (RFNA), and white fuming nitric acid (WFNA) from two minutes to four hours. A dose-time relationship is presented. The data obtained from male albino rats exposed to RFNA, WFNA, and NO_2 vapors indicate that the primary toxic constituent of the acids is NO_2; under conditions of the experiments, the acid vapors added a small, and probably insignificant, toxicity to the NO_2 vapors. A rise in the ambient temperature of about 20 degrees (F.) increased the toxicity of NO_2 to male rats by about 25%. Data obtained in the study suggest that there may be an appreciable strain variation in rats in response to the toxic action of NO_2. Death in all cases appeared to be due to pulmonary edema. The LC_{50} for exposure of male albino rats to NO_2 vapors for 30 and 240 minutes is 138 and 67 ppm, respectively. (auth)

504

TOXICITY OF THE OXIDES OF NITROGEN. III. EFFECT OF CHRONIC EXPOSURE TO LOW CONCENTRATIONS OF VAPORS FROM RED FUMING NITRIC ACID. Edward Le B. Gray, Stanley B. Goldberg, and Francis M. Patton (Army

Chemical Center, Md.). Arch. Ind. Hyg. and Occupational
Med. 10, 423-33(1954) Nov.

Rats, mice, and guinea pigs exposed four hours daily,
five days a week for six months to 4 ppm of vapors from red
fuming nitric acid exhibited no toxic effects. Because of
this, and because of work previously reported which showed
that 9 and 14 ppm of NO_2 produced lung pathology under
similar experimental conditions, it is felt that the MAC of
the oxides of nitrogen should be set at 5 ppm. (auth)

505

EXPERIMENTAL STUDIES IN METAL CANCERIGENESIS.
VI. TISSUE REACTIONS IN RATS AND RABBITS AFTER
PARENTERAL INTRODUCTION OF SUSPENSIONS OF
ARSENIC, BERYLLIUM, OR ASBESTOS IN LANOLIN. W.
C. Hueper (National Cancer Inst., Bethesda, Md.). J. Natl.
Cancer Inst. 15, 113-30(1954) Aug.

TRACER APPLICATIONS

506

Radiation Lab., Univ. of Calif., Berkeley
CARBON DIOXIDE FIXATION BY RHODOPSEUDOMONAS
CAPSULATUS. A. O. M. Stoppani, R. C. Fuller, and M.
Calvin. [1954]. 32p. Contract W-7405-eng-48. [UCRL-
2745]

507

METHOD FOR INCREASING THE ACCURACY OF THE
RADIOIODINE UPTAKE AS A TEST FOR THYROID FUNC-
TION BY THE USE OF DESICCATED THYROID. Monte A.
Greer and G. Edward Smith (National Cancer Inst.,
Bethesda, Md.). J. Clin. Endocrinol. and Metabolism 14,
1374-84(1954) Nov.

The effect of exogenous thyroid on I^{131} uptake in patients
with simple goiter and those with hyperthyroidism was in-
vestigated. A technique is described for differentiating
euthyroid and hyperthyroid patients who present either on
equivocal clinical picture or on equivocal thyroidal I^{131} ac-
cumulation. (C.H.)

508

COMPARATIVE STUDY OF EFFECTS OF PHENOTHIAZINE
AND IODINE ON THYROID UPTAKE OF I^{131}. H. I. Nachim-
son, R. H. Benson, J. J. Szafir, R. B. Turner, H. C. Allen,
Jr., and Roy V. Talmage (Veterans Administration Hospital,
Baylor Univ. Coll. of Medicine, and Rice Inst., Houston,
Texas). Proc. Soc. Exptl. Biol. Med. 87, 157-62(1954) Oct.

A comparison was made of the effects of free iodide (NaI
of KI) with the effects of phenothiazine N. F. (green) on the
supression of I^{131} uptake by thyroids in rats. (C.H.)

509

ASSOCIATION OF POLONIUM-210 WITH BLOOD. J. E.
Campbell and L. H. Talley (Mound Lab., Miamisburg, Ohio).
Proc. Soc. Exptl. Biol. Med. 87, 221-3(1954) Oct.

When whole blood from polonium-injected rats or dogs
was centrifugally fractionated, it was found that approxi-
mately 90% of the polonium was associated with the red
blood cells. Isolation of hemoglobin from similar blood in-
dicated that the polonium was associated with this portion of
the red blood cell. Fractionation of hemoglobin into globin
and heme indicated that almost all of the polonium was as-
sociated with the globin. Measurement of the affinity of
major red blood cell components for polonium demonstrated
that globin had as much affinity as lysed whole red cells,
while heme residue had practically none. Chemical methods

which rely on a change in hydrogen ion concentration for the
isolation of polonium containing red blood cell components
were not satisfactory. (auth)

510

ISOTOPIC TRACERS. A THEORETICAL AND PRACTICAL
MANUAL FOR BIOLOGICAL STUDENTS AND RESEARCH
WORKERS. G. E. Francis, W. Mulligan, and A. Wormall.
London, The Athlone Press, 1954. 306p. (Available from
John de Graff, Inc., New York City).

Data on the physical characteristics of radioactive iso-
topes and radiations, the types of apparatus and equipment
available, and the experimental techniques used in the in-
vestigations are presented in this book. (J.E.D.)

511

BIOLOGICAL STUDIES ON STABLE AND RADIOACTIVE
RARE EARTH COMPOUNDS. III. DISTRIBUTION OF
RADIOACTIVE YTTRIUM IN NORMAL AND ASCITES-
TUMOR-BEARING MICE, AND IN CANCER PATIENTS
WITH SEROUS EFFUSIONS. Ruth Lewin and Hiram E.
Hart (Coll. of the City of New York), Joseph Greenberg
(National Cancer Inst., Bethesda, Md.), Herta Spencer, Kurt
G. Stern, and Daniel Laszlo (Montefiore Hospital, New
York). J. Natl. Cancer Inst. 15, 131-44(1954) Aug.

The distribution of radio-yttrium, Y^{90}, following intra-
cavitary administration in ionized form, has been studied in
normal and Ehrlich ascites-tumor-bearing mice and in
terminal cancer patients. The retention of the radioisotope
in the injected cavity was markedly enhanced by the addition
of stable yttrium: at low carrier levels significant amounts
of Y^{90} were found in tissues distant from the injected cavity,
whereas relatively high carrier levels greatly reduced the
leakage from the cavity. In view of these observations and
of the favorable radiation characteristics of Y^{90} which re-
duce safety hazards to patient and personnel, the potential
usefulness of this isotope in the palliative therapy of carci-
nomatous effusions was discussed. (auth)

CHEMISTRY

512

Purdue Univ.
METAL ION CHELATE COMPLEXES. FINAL REPORT
COVERING PERIOD JULY 1, 1951 TO AUGUST 31, 1954.
Ronald T. Pflaum, Ronald R. Miller, Paul E. Holkeboer,
Bruce A. Swinehart, Harold F. Waldron, and Warren W.
Brandt. 96p. Contract AT(11-1)-160. (AECU-2959)

Data are presented from studies on the nature of some of
the amine complexes of the Cu(II) ion; the preparation of
tris-2,2'-bipyridine Ru(II) complex in aqueous medium, and
comparison to the corresponding Fe system; the chemical
properties of Mn complexes with 2,2'-bipyridine and 1,10-
phenanthroline; colorimetric determination of the Co 2,2',
2''-terpyridine complex; reactions in Cu 1,10-phenanthro-
line complexes; the design of an electromagnet and auxilia-
ry equipment for the measurement of magnetic suscepti-
bilities by a modified Gouy method; the formation of Ni com-
plexes with 2-nitroso-1-naphthol-4-sulfonic acid; the
formation of Os-bipyridine chelate compounds; and the
preparation and identification of complexes of Cr with 1,10-
phenanthroline, 2,2'-bipyridine, and 2,2'2''-terpyridine.
(C.H.)

513

Los Alamos Scientific Lab.

AUTOMATIC INSTRUMENTAL METHODS FOR THE
DETERMINATION OF CRITICAL SOLUTION TEMPERA-
TURES. John R. Mosley, Claude A. Lucchesi, and Ralph
H. Muller. [1954?] 18p. Contract [W-7405-eng-36].
(AECU-2965)

Several instrumental means for the determination of
critical solution temperatures using photoelectric detection
and control are described. Heater control is effected
either through a Schmitt trigger circuit or with limit
switches mounted on standard recorder. Temperature is
recorded on standard recording potentiometers. Precision
of measurement to ±0.01°C is obtainable although limita-
tions in volume measurement and reagent purity may easily
limit useful results to about ±0.05°C. (auth)

514

Los Alamos Scientific Lab.

THE PARTIAL PHASE DIAGRAM OF THE SYSTEM CaI_2-
CaF_2. William J. McCreary. [1954?]. 8p. Contract
[W-7405-eng-36]. (AECU-2968)

The phase diagram of the system CaI_2-CaF_2 is a simple
binary eutectic up to 53 mole % CaF_2. CaI_2 was purified by
vacuum distillation. The f.p. of CaI_2 is 783.7 ± 1.0°C, CaF_2
freezes at 1414 ± 5°C, and the eutectic composition of
17.5 mole % CaF_2 freezes at 667.9 ± 2°C. (auth)

515

Tennessee Univ.

SOME REACTIONS OF THE BORON HALIDES IN LIQUID AM-
MONIA (thesis). William Jackson McDowell. Mar. 1954.
94p. Includes reprint Behavior of an Ion-Exchange Resin in
Liquid Ammonia. C. W. Keenan and W[illiam] J[ackson]
McDowell. J. Am. Chem. Soc. 75, 6348(1953). For Mathieson
Chemical Corp. Contract [NDa(s)-52-1023-c]. (MCC-1023-
TR-34)

The reactions of the boron halides with liquid ammonia
and with ammonia solutions of alkali metals, a review of
the history of boron halides in liquid ammonia, and de-
scription of special equipment and materials are presented.
Methods of analysis of B compounds containing F, and
preparation, properties, solubility, and reactions with Li,
Na, K, Ce are reviewed. The preparation and reaction of
BF_3 with liquid ammonia are reported. A reprint on the
behavior of an ion-exchange resin in liquid ammonia is
included. (J.E.D.)

516

Rensselaer Polytechnic Inst.

ELECTROLYSIS STUDIES IN ORGANIC SOLVENTS.
Esther D. Fultz and John H. Wood. June 1954. 21p. [For
Mathieson Chemical Corp., Contract NOa(s)-52-1023-c].
(MCC-1023-TR-73)

Decomposition potentials of the systems $BF_3 \cdot O(C_2H_5)_2$-
HCl and $BCl_3 \cdot O(C_2H_5)_2$-HCl were measured, and effects of
varying the boron trihalide and HCl concentrations were
determined. Both platinum and graphite electrodes were
used. Gaseous products formed during extensive electroly-
sis were identified as oxygen and ethyl chloride, for the
case of $BCl_3 \cdot O(C_2H_5)_2$, and oxygen, ethyl chloride, ether,
and HCl, for the case of $BCl_3 \cdot O(C_2H_5)_2$-HCl. It was found
that $BCl_3 \cdot O(C_2H_5)_2$ decomposes on standing to form the
same products as those produced by extensive electrolysis.
Similar studies were made for the methyl borate azeotrope
of methanol. Extensive electrolysis of this azeotrope re-
sulted in the formation of hydrogen gas, acetone, methanol,
and a small quantity of unidentified material, distilling at
54.5° to 63.0°C. It is felt that electrolysis is not likely to
provide a new synthesis of diborane or of the higher boron
hydrides. However, in nonaqueous solvents, it is possible
that boron alkyls might be formed. (auth)

517

Southwest Research Inst.

DEVELOPMENT OF POLYNUCLEAR AROMATIC COM-
POUNDS FOR USE AS HIGH-TEMPERATURE LUBRI-
CANTS AND RELATED MATERIALS. QUARTERLY RE-
PORT NO. 3 [FOR] FEBRUARY 1, 1954 TO MAY 1, 1954.
Charles F. Raley, Jr. 29p. Contract AF33(616)-276,
Technical Report No. 7. (NP-5378)

518

Stanford Research Inst.

THE THERMODYNAMIC PROPERTIES OF MOLTEN
SALTS. QUARTERLY PROGRESS REPORT NO. 1 FOR
JUNE 1 TO AUGUST 31, 1954. A. P. Brady, J. K. Clauss,
and O. E. Myers. Oct. 22, 1954. 17p. Contract
AF33(616)-2558. (NP-5415)

A program for determining the thermodynamic prop-
erties of a number of salts in the high-temperature range
800 to 1900°F has been initiated. A literature survey was
made on the fluorides of Mo and Nb. Design was completed
and construction begun on a cryostat and a precision re-
cording double potentiometer with servoed current and
voltage sources. (J.S.R.)

519

Wayne Univ.

FUNDAMENTAL STUDIES IN ELECTRODEPOSITION.
FINAL REPORT [FOR FEBRUARY 1, 1952 TO JANUARY
31, 1954. Dan Trivich. Oct. 1954. 33p. Contract DA-
20-018-ORD-12079. (NP-5416)

The polarographic results for Cu in H_2SO_4 containing
thiourea reported in NP-4880 were verified. The actual
magnitude of the maxima are dependent on minor traces of
impurities. Improvements were made in the plating procedure
for the deposition of Cu from an acid Cu bath on Cu single
crystals. X-ray studies were made of the electrodeposits
on various crystal faces as a function of plating time.
Additional x-ray studies were made of deposits obtained at
various temperatures, current densities, and plating time,
adjusted to give a constant thickness of deposit. Different
procedures are discussed for the synthesis of S^{35}-labeled
sodium allyl sulfonate. (J.S.R.)

520

Massachusetts Inst. of Tech.

HYDROGEN PEROXIDE. PART 2. (CHAPTERS 5-6.
REPORT NO. 43. W. C. Schumb, C. N. Satterfield, and
R. L. Wentworth. Dec. 1, 1953. 238p. Contract N5ori-
07819. (NP-5424)

This section of the monograph on fundamental studies of
the properties, formation, and reactions of hydrogen
peroxide includes information appearing in the literature
up to Sept. 1, 1953, covering physical properties, thermo-
dynamic properties, electrical properties, effects of
radiation, the physical properties of multicomponent
systems containing H_2O_2, the physical properties of H_2O_2 of
other than natural isotopic composition, structure of the
H_2O_2 molecule, molecular association of H_2O_2, and litera-
ture citations. (C.H.)

521

Massachusetts Inst. of Tech.
HYDROGEN PEROXIDE. PART 4. (CHAPTERS 9-12).
REPORT NO. 45. W. C. Schumb, C. N. Satterfield, and
R. L. Wentworth. Nov. 1, 1953. 202p. Contract N5ori-
07819. (NP-5425)

This section of the monograph on fundamental studies
of the properties, formation, and reactions of hydrogen
peroxides includes information appearing in the literature
up to Aug. 1, 1953, covering stabilization, analytical
procedures, uses of H_2O_2 as a bleaching agent, other uses
as an oxidizing agent, use as an energy source, use of
gas formed on decomposition of H_2O_2, use as a source of
free radicals, effects on biological processes, use in
chemical synthesis, the classification and preparation of
inorganic peroxy compounds, peroxy acids and their salts,
and literature citations. (C.H.)

522

ELECTROCHEMICAL SERIES OF METALS IN MOLTEN
SALTS. Yu. [Iu.] K. Delimarskii. Translated by
Henry P. Thielman from Ukrain. Khim. Zhur. 16, 414-36
(1950). 37p. (AEC-tr-1969)

The electrode potentials of metals in various molten
salts were computed on the basis that the electrode
potential of Na is zero. The electrochemical series in a
given electrolyte changes only with temperature. The
differences among electrochemical series are caused by
the formation of complexes and by differences in the
anion. The values of the potentials of the heavy metals
become more negative with passage from molten chlorides
to bromides to iodides. The potentials are periodic
functions of the atomic numbers and are independent of
the solvent. (J.S.R.)

523

TITRATIONS IN NON-AQUEOUS SOLUTIONS. [PART] 9.
NEUTRALIZATION TITRATIONS IN ANHYDROUS FORMIC
ACID. Oldrich Tomíček and Prémysl Vidner. Translated
from Chem. Listy 47, 521-5(1953). 6p. Available from
Associated Technical Services (Trans. No. 32F4C), East
Orange, N. J. (AEC-tr-1978)

The possibilities of acid-base titrations in formic acid
were studied, and the acidity relations in this medium
were investigated. Scales of analogous exponents were
constructed. It was shown that the course of dehydration of
formic acid with acetic anhydride can be followed potentio-
metrically, and thus the water content of formic acid can
be roughly estimated. In formic acid solutions dehydrated
by this method, titrations of a series of bases with
perchloric acid solutions in the same solvent and, con-
versely, titrations of this acid with sodium formate were
carried out. The titrations were performed either potentio-
metrically with a quinhydrone indicator electrode or
visually with the use of gentian violet [crystal violet],
neutral violet, safranine, malachite green, and orange I as
indicators. (auth)

524

VAPOR PRESSURE STUDIES INVOLVING SOLUTIONS IN
LIGHT AND HEAVY WATERS. I. THE APPARATUS AND
THE DETERMINATION OF VAPOR PRESSURES AT 30° OF
SOLUTIONS OF SODIUM AND POTASSIUM CHLORIDES IN
ORDINARY WATER. Hilton A. Smith, Robert L. Combs,
and John M. Googin (Univ. of Tennessee, Knoxville).
J. Phys. Chem. 58, 997-9(1954) Nov.

An apparatus for the determination of the vapor pressures

of solutions relative to the vapor pressure of water is de-
scribed. The vapor pressure lowerings of water at 30.1°C
caused by additions of 3.755 to 5.162$\underline{M}$ NaCl were from
0.139 to 0.188 and for 0.754 to 3.957$\underline{M}$ KCl were from
0.0225 to 0.130. (J.A.G.)

525

DISTRIBUTION OF CHARGED POLYMERS AT EQUILIBRI-
UM IN A CENTRIFUGAL FIELD. James S. Johnson, Kurt
A. Kraus, and George Scatchard (Oak Ridge National Lab.,
Tenn. and Massachusetts Inst. of Tech., Cambridge).
J. Phys. Chem. 58, 1034-9(1954) Nov.

Equilibrium ultracentrifugation of monodisperse polymer
systems in the presence of supporting electrolytes is dis-
cussed with particular emphasis on low molecular weight
polymers of relative high charge. Errors introduced in the
estimation of molecular weights by neglect of this charge
are evaluated. An equation is developed for the determina-
tion of molecular weights or degrees of aggregation of
charged polymers in the presence of supporting electrolyte.
Application of this equation to the usual centrifuge data in-
volving refractive index gradients is described. (auth)

526

OXYGEN TRANSFER BETWEEN CARBON DIOXIDE AND
CARBON MONOXIDE IN THE PRESENCE OF CARBON.
A. A. Orning (Carnegie Inst. of Tech., Pittsburgh, Penna.)
and E. Sterling (E. I. DuPont DeNemours and Co., Gibbs-
town, N. J.). J. Phys. Chem. 58, 1044-7(1954) Nov.

Radioactive carbon, C^{14}, was used as a tracer to study
oxygen transfer reactions between CO_2 and CO in the pres-
ence of different carbons in the temperature range from 650
to 900°. The reaction was dependent as much upon the phys-
ical state of the carbon as upon composition and the pres-
ence of catalytic agents. Oxygen transfer, between carbon
oxidizing and reducing gases, is a probable reaction step in
the gasification of carbon that explains many observations
of the kinetics of the gasification reaction. The tracer
technique is discussed as a tool for testing theories on the
mechanism of these reactions between gases and solids.
(auth)

527

THE SURFACE TENSION OF POTASSIUM. W. Primak and
L. A. Quarterman (Argonne National Lab., Lemont, Ill.).
J. Phys. Chem. 58, 1051-2(1954) Nov.

The determination of the surface tension of liquid K by
the drop-weight method is discussed. The weight of K was
determined from the heat transfer coefficient, the length of
the freezing curve, and the known heat of fusion. The heat
transfer coefficient was obtained from the slope of the cool-
ing curve just prior to freezing, and the heat capacity was
determined electrically. The surface tensions were com-
puted using the Harkins-Brown function, $\phi/(r/V^{1/2})$, by the
formula $\delta = gm/2\pi \phi = 5180m/\phi$, where g is the accelera-
tion due to gravity, m the weight of a single drop, and r the
capillary radius. The results are tabulated. (J.A.G.)

528

STUDIES ON THE ELECTROLYTIC PREPARATION OF
BERYLLIUM OXIDE FROM BERYL. P. B. Chakravarti and
T. Banerjee (National Metallurgical Lab., Jamshedpur,
India). J. Sci. Ind. Research (India) 13, 625-33(1954) Sept.

An electrolytic method is described for the production of
beryllium oxide from a solution containing sodium beryllium
fluoride, obtained by leaching a sintered mass of beryl with
sodium silicofluoride or sodium ferric fluoride. High ap-
parent current efficiency was generally obtained for the

process, exceeding 100 per cent in some of the experiments. This abnormally high apparent current efficiency has been shown to be due to: (1) impurities like silica, alumina and iron oxide accompanying beryllium hydroxide and (2) the electrodeposited hydroxide carrying down with it the complex fluoride by adsorption. (auth)

529

CONTRIBUTIONS TO THE DATA ON THEORETICAL METALLURGY. XII. HEATS AND FREE ENERGIES OF FORMATION OF INORGANIC OXIDES. James P. Coughlin (Bureau of Mines, Washington, D. C.). U. S. Bur. Mines Bull. 542, 1954. 80p. $0.45.

Heat and free energy of formation data are compiled for ozone and the oxides of Ac, Al, Am, Sb, As, Ba, Be, Bi, B, Cd, Ca, C, Ce, Cs, Cl, Cr, Co, Cu, F, Ga, Ge, Au, Hf, H, In, I, Ir, Fe, La, Pb, Li, Mg, Mn, Hg, Mo, Nd, Np, Ni, Nb, N, Os, Pd, P, Pu, Po, K, Pr, Ra, Re, Rh, Rb, Ru, Sm, Sc, Se, Si, Ag, Na, Sr, S, Ta, Tc, Te, Tl, Th, Sn, Ti, W, U, V, Y, Zn, and Zr. (J.S.R.)

530

RATE OF THE FERROCYANIDE-FERRICYANIDE EXCHANGE REACTION. Arthur C. Wahl (Washington Univ., St. Louis, Mo.) and Charles F. Deck (Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 76, 4054(1954) Aug. 5.

AEROSOLS

531

Columbia Univ.
FILTRATION OF MONODISPERSE SOLID AEROSOLS. PROGRESS REPORT [FOR] SEPTEMBER 1, 1953—AUGUST 31, 1954. Vadim G. Drozin and David L. Hochberg. Aug. 31, 1954. 45p. Contract AT(30-1)-1434. (NYO-4603)

Data are presented from studies of the effect of concentration on penetration of monodisperse liquid and solid aerosols and the efficiency of low-efficiency and plug filters for aerosol removal. Hydrodynamic theories of filtration and the effects of pressure drop on filtration are discussed. An apparatus for the charging of wax aerosols is described, and the filtration of charged wax aerosols is reported. The operation of the La Mer–Sinclair generator for the production of monodisperse liquid or solid aerosols is discussed in an appendix. (For preceding period see NYO-4526.) (C.H.)

ANALYTICAL PROCEDURES

532

Illinois Inst. of Tech.
THE DETERMINATION OF Hg-202 AND OTHER MERCURY ISOTOPES IN SAMPLES OF MERCURY VAPOR BY MERCURY RESONANCE RADIATION ABSORBIOMETRY. K. R. Osborn and H. E. Gunning. [Sept. 1, 1954]. 11p. Contract AT(11-1)-43. (AECU-2953)

A method is described for the determination of the percentage of Hg^{202} present in small samples of mercury. An electrodeless discharge tube containing Hg^{202} is used as a source of the Hg^{202} hyperfine component of the 2537 A resonance line of mercury. By determining the absorbance of this component by mercury vapor, the quantity of the isotope present in the vapor can be determined. The analyses of samples of mercury containing various percentages of Hg^{202} agree with values obtained by mass spectrometric methods to within two per cent. The method has the advantage over the mass spectrometer of requiring very much smaller samples. Furthermore, contamination from "hang-up" of previous samples is avoided. Through the use of other isotopic sources it is shown that the method could be extended to the analysis of the remaining isotopes of mercury. (auth)

533

Phillips Petroleum Co. Atomic Energy Div.
THE DETERMINATION OF SMALL AMOUNTS OF HEXONE IN AQUEOUS URANIUM SOLUTIONS. B. E. Paige, H. Sigman, and J. E. Rein. Oct. 13, 1954. 16p. Contract AT(10-1)-205. (IDO-14320)

A spectrophotometric method is described for the determination of hexone (2-pentanone, 4-methyl-) in aqueous solutions containing large amounts of uranium. It is based on a separation by distillation of the hexone followed by measurement of its optical absorbancy at 2725 A. Sampling presents the greatest source of error because the relatively high vapor pressure of hexone causes its loss at room temperature and atmospheric pressure. Interferences are mainly restricted to organic compounds with relatively high vapor pressures and optical absorbancies at the 2700 A region. The reliable lower limit of the method is 0.01% in terms of the hexone content (volume percent) in the original sample. The experimental reliability expressed as the standard deviation is approximately 0.001%, also in terms of the volume percent of hexone in the sample. (auth)

534

Health and Safety Lab., New York Operations Office, AEC ANALYSIS FOR LONG-LIVED PRODUCTS IN SOIL. N. I. Sax, J. J. Gabay, D. Revinson, and B. Keisch. Sept. 1, 1954. 24p. (NYO-4604)

Results are reported from an analysis for long-lived fission products in a sample of Marshall Islands soil contaminated by heavy fall-out following the March 1, 1954, nuclear tests. An attempt was made to account for the total activity of the sample. Chemical procedures for the separation of the Sr, Ru, rare earth, and Zr groups are given in an appendix. (C.H.)

535

TITRATIONS IN NON-AQUEOUS SOLUTIONS. [PART] 7. TITRATIONS IN GLACIAL ACETIC ACID BASED ON THE FORMATION OF INSOLUBLE SALTS. Oldrich Tomiček and Marie Zukriegeloyá. Translated from Chem. Listy 46, 263-7(1952). 9p. Available from Associated Technical Services (Trans. No. 29F4C), East Orange, N. J. (AEC-tr-1976)

In the course of study of some of the oxidation-reduction titrations in glacial acetic acid, it was necessary to determine the hydrogen halides produced. For this purpose a new titrimetric determination in glacial acetic acid, based on the production of slightly soluble or complex salts, was carried out and tested. For titration of halides in this medium an especially successful titrating solution, in addition to lead and mercuric acetate, was thallous acetate in glacial acetic acid. Equally successful is the converse use of lithium chloride or bromide solution in the same solvent for the titration of the acetates mentioned above. A titration on the semi-micro scale is best carried out potentiometrically, although it can also be carried out with sufficient precision visually, using nitroprusside as a turbidity indicator, or diphenyl carbazone (with mercuric acetate) and the adsorption indicators neutral red, thionine, and safranine. (auth)

536

TITRATIONS IN NON-AQUEOUS SOLUTIONS. [PART] 8. SOME REDUCTOMETRIC TITRATIONS IN GLACIAL ACETIC ACID. Oldřich Tomíček, Alena Stodolová, and Miloš Heřman. Translated from Chem. Listy 47, 516-20(1953). 6p. Available from Associated Technical Services (Trans. No. 31F4C), East Orange, N. J. (AEC-tr-1977)

The possibilities of reductometric determinations in glacial acetic acid were explored, using sodium dithionite [$Na_2S_2O_4$], vanadyl acetate, arsenic trichloride, pyrocatechol, and stannous chloride as volumetric reducing agents with the usual oxidizers. The mechanism of the reactions, especially with sodium dithionite and vanadyl acetate, was outlined. It was confirmed that even in glacial acetic acid their reducing power varies with the acidity of the medium under the influence of the addition of a strong acid or base. (auth)

537

THE DETERMINATION OF SMALL AMOUNTS OF LITHIUM. C. F. Forster (Post Office Engineering Dept., London, England). Analyst 79, 629-35(1954) Oct.

A method was devised for quantitatively separating microgram quantities of lithium from an excess of Na and K salts by precipitating the lithium potassium ferricyanide hexamethylenetetramine complex from an acetone—water solution. The yellow complex can be separated by filtration and weighed, or redissolved in water, and the lithium determined absorptiometrically. (auth)

538

POLAROGRAPHIC INVESTIGATION OF SULFURIC ACID SOLUTIONS OF TITANIUM AND NIOBIUM. E. I. Krylov, V. S. Kolebatova, and V. A. Samarina. Dokady Akad. Nauk S.S.S.R. 98, 593-5(1954) Oct. 1. (In Russian)

Polarographic waves of Nb and Ti in sulfuric acid solution are given. The basic conditions for the polarographic quantitative determination of these elements in common solution were determined. (J.S.R.)

539

POLAROGRAPHIC DETERMINATION OF CHLOROACETALDEHYDES. ANALYSIS OF MIXTURES. Philip J. Elving and C. Eugene Bennett (Univ. of Michigan, Ann Arbor and Pennsylvania State Univ., State Coll.). Anal. Chem. 26, 1572-5(1954) Oct.

Existing methods for the determination of chloral hydrate are briefly reviewed. The need is evident for methods for the determination of chloral hydrate in the presence of other chloroaldehydes, and for the determination of the chloroacetaldehydes in the presence of other aldehydes. Polarographic methods are described for the determination of any individual chloroacetaldehyde in the absence of the other two and of chloral hydrate in the presence of either or both dichloro- and chloroacetaldehyde, and for the analysis of certain mixtures of chloral hydrate and dichloro- or chloroacetaldehyde. Mixtures of dichloro- and chloroacetaldehyde cannot be analyzed by direct polarographic methods, for the two compounds give coincident waves in the usual buffer systems. The precision for determination of the individual chloroacetaldehyde alone or in the presence of others as specified is about 3%. (auth)

540

AMPEROMETRIC TITRATION OF ZIRCONIUM. APPLICATION TO FLUORIDE SOLUTION. Edward C. Olson and Philip J. Elving (Univ. of Michigan, Ann Arbor). Anal. Chem. 26, 1747-50(1954) Nov.

Although Zr and its alloys are readily dissolved in hydrofluoric acid, the resulting solutions offer difficulties in the subsequent determination of Zr. Accordingly, a method was sought for the direct determination of Zr in the presence of excess fluoride ion. The amperometric titration of Zr with cupferron in $2M$ sulfuric acid solution was found to provide a satisfactory solution. The analytical precision is 0.4% or better. The method is subject to few interferences and may be applied without preliminary treatment to solutions containing Zr in the presence of a 30- to 35-fold excess of fluoride ion without loss of accuracy; if Al is added, a much higher molar excess of fluoride can be tolerated. A gravimetric modification of the method may be used in solutions containing nearly a thousandfold excess of fluoride. (auth)

541

LITHIUM ISOTOPE DETERMINATION BY NEUTRON ACTIVATION. Louis Kaplan and K. E. Wilzbach (Argonne National Lab., Lemont, Ill.). Anal. Chem. 26, 1797-8(1954) Nov.

The large absorption cross section of Li^6 for thermal neutrons, with the resultant production of T is utilized for the isotopic determination of Li. Solutions of known Li concentration are irradiated in a nuclear reactor. The T produced affords a direct measure of the relative Li^6 content of the solutions. The only significant interference is from Li impurity in the quartz irradiation tube. The precision of a Li^6 determination is within 1%. (auth)

542

RAPID DETERMINATION OF URANIUM IN COMPLEX MINERALS LIKE SAMARSKITE, COLUMBITE-TANTALITE AND TITANONIOBATES. I. VOLUMETRIC DETERMINATION. Mahadeo M. Tillu (Atomic Energy Commission, Bombay, India). Proc. Indian Acad. Sci. A40, 110-13(1954) Sept.

After breaking the samarskite and complex minerals with hydrofluoric acid, the hexavalent uranium in the sample is reduced to the tetravalent state by addition of excess stannous chloride. Uranium is thus precipitated as tetrafluoride along with the fluorides of thorium, rare earths and the alkaline earths, which do not interfere in subsequent titration of uranium after reduction in the Jones Reductor. The method is simple, and rapid, and uranium contents in samarskite, columbite-tantalite, and titanoniobate can be determined within the period of one and half working days. (auth)

543

DETERMINATION OF BISMUTH IN METALLURGICAL PRODUCTS. Jorma Kinnunen and Bertil Wennerstrand (Outokumpu Oy, Metalworks, Pori, Finland). Chemist Analyst 43, 88-9(1954) Nov.

The procedure for the determination of Bi in metallurgical products described involves a preliminary separation of Bi with sodium diethyldithiocarbamate and titration with ethylenediaminetetraacetic acid using Pyrocatechol Violet as an indicator. (C.H.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

544

THE CRYSTAL STRUCTURE OF YTTRIUM TRICHLORIDE AND SIMILAR COMPOUNDS. D. H. Templeton and Giles F. Carter (Univ. of California, Berkeley). J. Phys. Chem. 58, 940-4(1954) Nov.

The crystal structure of yttrium trichloride has been determined from single crystal x-ray diffraction data. It is found to have a structure like that of aluminum chloride; monoclinic, space group C2/m, with lattice dimensions a = 6.92 A, b = 11.94, c = 6.44, and β = 111.0°. Atomic parameters have been determined by Fourier methods. The structure can be described as a slightly distorted sodium chloride type with two-thirds of the metal atoms omitted. Lattice dimensions determined from powder data are reported for dysprosium trichloride, holmium trichloride, erbium trichloride, thulium trichloride, ytterbium trichloride, lutetium trichloride, thallium trichloride and indium trichloride, all of which have this same structure. (auth)

DEUTERIUM AND DEUTERIUM COMPOUNDS
545

VAPOR PRESSURE STUDIES INVOLVING SOLUTIONS IN LIGHT AND HEAVY WATERS. II. THE VAPOR PRESSURE OF HEAVY WATER AND THE SEPARATION FACTOR OF THE MIXED WATERS. Robert L. Combs, John M. Googin, and Hilton A. Smith (Univ. of Tennessee, Knoxville). J. Phys. Chem. 58, 1000–1(1954) Nov.

Vapor pressure measurements of D_2O from 10 to 55°C showed a linear increase of 7.70 to 106.6mm. Measurements of H_2O-D_2O mixtures from 9.84 to 50°C showed an increase of 8.45 to 87.86mm. The separation factor, α = (H/D)$_{gas}$/(H/D)$_{liquid}$ was also determined for the two mixtures. (J.A.G.)

FLUORINE AND FLUORINE COMPOUNDS
546

Michigan State Coll.
INTERFEROMETRIC STUDIES OF THE REFRACTIVE INDICES OF SOME FLUORINE COMPOUNDS (thesis). Jim Gordon Malik. (Cover bears title: PHYSICAL PROPERTIES OF THE HALOGEN FLUORIDES AND OTHER COMPOUNDS OF FLUORINE. Max T. Rogers, John L. Speirs, and Jim G[ordon] Malik). Aug. 1954. 145p. Contract AT(11-1)-151. (AECU-2961)

Design, construction, and calibration of a Rayleigh type interferometer, the use of the interferometer for solution measurements, and design of a vacuum system for handling both unreactive gases and the corrosive halogen fluorides are described. The molar refractions of potassium chloride, sodium chloride, ammonium fluoborate, fluoboric acid, sodium fluoborate, sodium fluoride, sodium silicofluoride, potassium silicofluoride, potassium fluotitanate, potassium bifluoride, potassium ferrocyanide, and potassium ferricyanide were determined at infinite dilution from the measured refractive indices and densities of dilute aqueous solutions of each. A set of ionic refractions has been calculated from these molar refraction values which reproduces the observed molar refractions with a mean deviation of ± 0.04 cc./mole. The ionic refractions were assigned to the atoms in the ratio of the volume of the free spheres calculated from the ionic radii. The refractive indices of nitrogen, chlorotrifluoroethylene, perfluoroethyl ether, 1,1,1,2,2,3,3-heptafluoropropane, perfluorotriethyl amine, chlorine monofluoride, chlorine trifluoride, bromine trifluoride, bromine pentafluoride, and iodine pentafluoride were determined, and the respective molar refractions were calculated. An empirical procedure was devised to estimate degree of ionic character in simple molecules. The value of the ionic character determined in this manner was compared with the percent ionic character as determined by the electronegativity differences for the atoms involved. (auth)

547

Michigan State Coll.
AN INVESTIGATION OF THE ELECTRIC MOMENTS OF SOME COMPOUNDS OF FLUORINE (thesis). Richard D. Pruett. (Cover bears title: PHYSICAL PROPERTIES OF THE HALOGEN FLUORIDES AND FLUOROCARBONS. Max T. Rogers, John L. Speirs, and Richard D. Pruett). Aug. 1954. 132p. Contract AT(11-1)-151. (AECU-2962)

Equipment for measuring the dielectric constants of compounds in the vapor phase over a range of temperatures was constructed and used to determine the dipole moments of eight compounds containing fluorine. Dielectric cells and auxiliary equipment were constructed both for measurements on high-boiling corrosive liquids and for measurements on ordinary low-boiling liquids. The compounds studied and the values of their dipole moments were bromine pentafluoride, 1.40 ± 0.14 D; chlorine trifluoride, 0.74 ± 0.11 D; iodine pentafluoride, 2.24 ± 0.09 D; bromine trifluoride, 1.33 ± 0.14 D; 1,1,1,2,2,3,3-heptafluoropropane, 1.62 ± 0.10 D; perfluorotetramethylene oxide, 0.56 ± 0.12 D; perfluoroethyl ether, 0.51 ± 0.12 D; and chlorotrifluoroethylene, 0.38 ± 0.10 D. The dipole moment of chlorine trifluoride agreed reasonably well with that predicted from its known structure. The observed electric moment supports a similar structure for bromine trifluoride. The high dipole moments observed for bromine pentafluoride and iodine pentafluoride show that they cannot have symmetrical structures. The large moments can be accounted for on the basis of either a regular octahedral structure or a distorted octahedral structure, although the latter gives better agreement with the data for iodine pentafluoride. Dipole moments were calculated for the fluorocarbon derivatives from bond moments and compared with the experimental values. The calculated values agreed with the observed moments if the inductive effects of the strong C-F dipoles were considered. (auth)

548

THE VAPOR PRESSURE OF ZIRCONIUM FLUORIDE. Karl A. Sense, M. J. Snyder, and R. B. Filbert, Jr. (Battelle Memorial Inst., Columbus, Ohio). J. Phys. Chem. 58, 995-6 (1954) Nov.

The vapor pressures of ZrF_4 were measured over the temperature range 616 to 881°C and pressure range 0.3 to 470 mm using the transpiration method. The extrapolated sublimation point was 903°C. (auth)

LABORATORIES AND EQUIPMENT
549

Hanford Works
FIBERGLASS AIR FILTERS FOR HOT LABORATORIES. L. E. Kattner and J. F. Gifford. June 18, 1954. 23p. Contract W-31-109-Eng-52. (HW-30781)

Three sizes of disposable fiberglass filters have been used in Hanford laboratories over the past three years for filtration of hot exhaust air from hoods and gloved boxes. The outstanding characteristics of these filters are their low cost and their ready disposability due to low weight and due to the seal method used. This report presents pictures and operating characteristics for the three filters and

compares the hood filter with a corresponding Chemical
Warfare Service filter in some detail. (auth)

550

HIGH-RADIATION-LEVEL ANALYTICAL LABORATORY.
E. J. Frederick (Oak Ridge National Lab., Tenn.). Nucle-
onics 12, No. 11, 36-7(1954) Nov.

Design features of the proposed high-radiation-level
analytical laboratory at ORNL include seven work cells and
a 2,000-sample centrally located storage cell shielded by
3 ft of concrete, windows of Ce-stabilized glass, working
windows filled with Zn bromide, and all handling done by
Argonne Model-8 master-slave manipulators. Interior sur-
faces of all cells are painted with white Amercoat-33 and
have a layer of strippable coat. Design details are illus-
trated by schematic sketches. (C.H.)

551

LOW-RADIATION-LEVEL METALLURGY CELL. A. R.
Lumbert (Massachusetts Inst. of Tech., Cambridge).
Nucleonics 12, No. 11 38-9(1954) Nov.

Radioactive metallurgical specimens are removed from
shipping cans, sorted, and subjected to physical and me-
chanical tests in a metallurgy cell designed for low-level
radiation work. Design features are described and illus-
trated by schematic sketches. (C.H.)

552

HOT CELLS FOR RADIUM PROCESSING. H. E. Feirstein
(Mound Lab., Miamisburg, Ohio). Nucleonics 12, No. 11,
40-1(1954) Nov.

Gram quantities of irradiated Ra^{226} are separated from
other irradiated products in Lucite-contained cells installed
in a cave structure at Mound Lab. The layout, process flow,
and special equipment used to protect operating and main-
tenance personnel from γ radiation and radioactive gaseous
daughter products are described and illustrated by a sche-
matic sketch and photographs. (C.H.)

553

HOT CELL FOR TESTING MTR-IRRADIATED SPECIMENS.
M. H. Bartz and J. B. Burnham, Jr. (Phillips Petroleum
Company, Idaho Falls). Nucleonics 12, No. 11, 42-3(1954)
Nov.

Design features are described of a cell built near the
Materials Testing Reactor to provide facilities for dis-
sembling irradiated plugs and capsules, testing irradiated
samples, preparing specimens for shipment to other labo-
ratories, and for machining irradiated solids. The cell is
designed for flexible adaptation to a variety of operations.
(C.H.)

554

LAB FOR RADIOCHEMISTRY, METALLURGY TEST. R.
W. Fisher and G. R. Winders (Ames Lab., Iowa). Nucle-
onics 12, No. 11, 44(1954) Nov.

Facilities used for radiochemistry and metallurgy tests
at Ames Lab. include a cave shielded by an 8-in. steel plate
supported on a 12-in. concrete wall and having a 2-in. inner
lining of lead brick. Details of design are described and
illustrated by schematic sketches. (C.H.)

555

MECHANICAL MASTER-SLAVE MANIPULATOR. R. C.
Goertz (Argonne National Lab., Lemont, Ill.). Nucleonics
12, No. 11, 45-6(1954) Nov.

The Argonne National Lab. model 8 master-slave manipu-
lator is described in detail. (C.H.)

556

ELECTRONICALLY CONTROLLED MANIPULATOR. R. C.

Goertz and W. M. Thompson (Argonne National Lab.,
Lemont, Ill.). Nucleonics 12, No. 11, 46(1954) Nov.

A general-purpose servo-manipulator is described which
needs only electrical connections between the master and
slave. (C.H.)

557

HEAVY-DUTY HYDRAULIC MANIPULATOR. L. N. Howell
and A. M. Tripp (Oak Ridge National Lab., Tenn.). Nucle-
onics 12, No. 11, 48-9(1954) Nov.

Design details are presented for a general-purpose plug-
in manipulator with slave motion and feedback of feel pro-
vided by simple hydraulic servomechanisms. (C.H.)

558

EQUIPMENT FOR PROCESSING REACTOR FUELS. G. R.
Winders, E. H. Dewell, R. G. Clark, M. D. Voss, and K. L.
Malaby (Ames Lab., Iowa). Nucleonics 12, No. 11, 50-1
(1954) Nov.

Design is described of remotely controlled hot-slug
dejacketers, hot-slug saws, radiation-thimble strippers,
crucible removers, and sample dissolvers used at Ames
Lab. for processing reactor fuel elements. (C.H.)

559

HYDRAULICALLY OPERATED REMOTE PIPETTER.
K. H. Hammill (Hanford Atomic Products Operation,
Richland, Washington). Nucleonics 12, No. 11, 52-3(1954)
Nov.

Design is described of a hydraulically operated remotely
controlled micropipetter. The set-up described allows
$1-\mu l$ samples to be measured with $\pm 3\%$ accuracy. (C.H.)

560

HOT-LAB FIBERGLAS AIR FILTERS. John F. Gifford
(Hanford Atomic Products Operation, Richland, Wash.).
Nucleonics 12, No. 11, 54(1951) Nov.

Design features and efficiency are discussed of three dis-
posable Fiberglas filters used for filtering exhaust air from
individual hoods and gloved-boxes. (C.H.)

561

CRANE AND FORK LIFT FOR REMOTE HANDLING. D. W.
Huszagh (Brookhaven National Lab., Upton, N. Y.).
Nucleonics 12, No. 11, 55(1954) Nov.

562

REMOTE METALLOGRAPHIC EQUIPMENT. I. REMOTE
MICROSCOPY. S. H. Paine, F. L. Brown, R. A. Blomgren,
N. J. G. Bohlin, and L. W. Haaker (Argonne National Lab.,
Lemont, Ill.). Nucleonics 12, No. 11, 56-8(1954)

The preparation of polished specimens irradiated in nu-
clear reactors is accomplished by adaptation of a Bausch
and Lomb Research Metallograph. The remote equipment
described is capable of handling up to 25c of Co^{60}, and is
designed for the principal purpose of providing maximum
speed with quality results, and a minimum of radioactive
contamination. (K.S.)

563

REMOTE METALLOGRAPHIC EQUIPMENT. II. SAMPLE
PREPARATION. F. L. Brown and S. H. Paine (Argonne
National Lab., Lemont, Ill.). Nucleonics 12, No. 11, 58-9
(1954) Nov.

The preparation of samples from nuclear reactors for
metallography is performed in a three-cell intermediate-
level cave. The three cells for the rough preparation, final
preparation, and specimen-study steps are described.
(M.P.G.)

564

HANDLING IRRADIATED FUEL-SPECIMEN CAPSULES.

J. H. Kittel (Argonne National Lab., Lemont, Ill.). Nucleonics 12, No. 11, 60(1954) Nov.

The procedure for opening irradiated fuel-specimen capsules and removing the NaK and the specimen is described. (M.P.G.)

565

LOW-COST PLASTIC SEALER. H. Susskind (Brookhaven National Lab., Upton, N. Y.). Nucleonics 12, No. 11, 61 (1954) Nov.

A device for sealing plastic in dry-box operations is described. The sealer utilizes both heat and pressure to effect a good seal in less than 20 sec. (M.P.G.)

566

BINOCULAR PERISCOPE VIEWERS. J. M. Holeman (Hanford Atomic Products Operation, Richland, Wash.). Nucleonics 12, No. 11, 64(1954) Nov.

Types of stereoscopic periscopes are discussed and compared. A partial-aperture system with one set of lenses for both eyes proved workable and is described. (M.P.G.)

567

ADVANTAGES OF ULTRASONIC CLEANING. M. J. Feldman (Oak Ridge National Lab., Tenn.). Nucleonics 12, No. 11, 65-6(1954) Nov.

Ultrasonic cleaning of metallographic specimens is described and recommended for hot cell operations. (M.P.G.)

568

REMOTE LIQUID SAMPLING: A COMPLETELY AUTOMATIC AIR-LIFT SYSTEM. H. G. Duggan and J. W. Landry (Oak Ridge National Lab., Tenn.). Nucleonics 12, No. 11, 67-9(1954) Nov.

A remote process-stream sampler has been devised for taking 40 samples simultaneously. Vacuum systems are used to draw the solution to the sample bottles which are then automatically transported to the laboratory. Tests indicate that the system will be reliable and easy to operate. (M.P.G.)

569

LARGE-SCALE AUTOMATIC STORAGE AND SAMPLING UNIT. T. L. Trent, Jr. and J. J. Wallace (Oak Ridge National Lab., Tenn.). Nucleonics 12, No. 11, 70-1(1954) Nov.

Equipment has been designed to select, remove from storage, sample, and return to storage liquids such as those taken from the product stream of a separation process. Sampling cycle is automatic, requiring about 7 min for up to 12 samples, but manual operation is possible. (M.P.G.)

570

EQUIPMENT FOR REMOTE CHEMICAL SEPARATIONS. L. F. Miller and E. M. Kinderman (Hanford Atomic Products Operation, Richland, Wash.). Nucleonics 12, No. 11 82-3(1954) Nov.

The modified hot-cell technique described was developed for the separation of transplutonium isotopes. The processing equipment is in a dry box located within a modified multicurie cell. Cell access and viewing are provided from all sides and the top. Simple, readily exchangeable, one-function manipulators serve as short extensions of the hands. Work is done through the top in over-the-wall fashion, a sectioned top closure permits minimum open space with maximum velocity of inward-flowing air, and a high-capacity filtered air exhaust is provided. (C.H.)

571

SEPARATING TRANSPLUTONIUM ISOTOPES FROM IR-

RADIATED PLUTONIUM. William Ruehle, Jr. (Univ. of California, Berkeley). Nucleonics 12, No. 11, 84-5(1954) Nov.

A dry box in a modified cave was equipped with apparatus necessary for the separation of transplutonium isotopes from irradiated Pu. Shielding and chemical processing equipment are described and illustrated. (C.H.)

572

OPERATING A MANIPULATOR CELL. E. E. Pierce (Oak Ridge National Lab., Tenn.). Nucleonics 12, No. 11, 86-7 (1954) Nov.

The manipulator cell described was designed for the preparation of radioactive sources and is provided with auxiliary cubicles for chemical processing and source calibration. The cell utilizes two master-slave manipulators. Specialized tools handled by manipulators are illustrated photographically. Use of the equipment in the preparation of a 1540 c Cs^{137} teletherapy source is described. (C.H.)

573

PREPARING NEUTRON SOURCES. John L. Richmond (Mound Lab., Miamisburg, Ohio). Nucleonics 12, No. 11, 88(1954) Nov.

The apparatus described uses a hydraulic manipulator and relay-controlled processing for assembling, sealing, and processing Po-Be neutron sources. (C.H.)

574

OPERATING BUSY HOT CELLS. S. Dismuke (Oak Ridge National Lab., Tenn.). Nucleonics 12, No. 11, 89-90(1954) Nov.

Design features and the operational administration of busy hot cells used for solid-state studies are discussed. (C.H.)

575

OPERATING THE HANFORD RADIOMETALLURGY LABORATORY. L. D. Turner (Hanford Atomic Products Operation, Richland, Wash.). Nucleonics 12, No. 11, 91(1954) Nov.

Advantageous features and limitations of the radiometallurgy laboratory at Hanford are discussed. (C.H.)

576

KEEPING COSTS DOWN IN AN ANALYTICAL HOT LAB. E. W. Christopherson (Hanford Atomic Products Operation, Richland, Wash.). Nucleonics 12, No. 11, 94-5(1954) Nov.

Economical procedures for the organization, sampling, analysis, and safety procedures for a radiochemistry analytical laboratory are described. (C.H.)

577

UNITIZED HANDLING OF IRRADIATED FUELS. L. O. Sullivan (Knolls Atomic Power Lab., Schenectady, N. Y.). Nucleonics 12, No. 11, 96-7(1954) Nov.

Techniques evolved over a three-and-one-half year period for the efficient handling of irradiated fissionable materials are described. The work area has plastic-film walls and canopy, is serviced by master slaves, and provided with a filtered exhaust system. This provides versatile manipulation, and adequate control of contamination which increases productivity per unit volume of cell space. (C.H.)

578

OPERATING PROCEDURES OF A HOT LAB FOR SOLID-STATE TESTS. E. W. Rylander and R. A. Blomgren (Argonne National Lab., Lemont, Ill.). Nucleonics 12, No. 11, 98-100(1954) Nov.

Management procedures and facilities of ANL's laboratory for physics and metallurgy studies employing radio-

active materials are described. The laboratory includes two high-level cells and one three—cell intermediate-level cave. (C.H.)

RADIATION CHEMISTRY

579

THE CHEMICAL POTENTIAL OF WASTE FISSION PRODUCTS. Ernest J. Henley (Columbia Univ., New York City). NUCLEAR ENGINEERING, PART III, Chem. Eng. Progr. Symposium Ser. No. 13, 66-72(1954).

The role of high radiation intensities provided by reactors and radioactive products is discussed in connection with a large number of industrial and chemical processes. An attempt is made to evaluate the chemical uses of radiation, such as catalysis and polymerization, in inorganic and organic systems. It is concluded that present knowledge of quantitative and qualitative mechanisms restrict immediate use of radiation techniques to high-pressure phenomena, the development of unknown reactions, and the improvement of processes now carried out at low yields in expensive equipment. (K.S.)

580

RADIOCHEMISTRY OF AQUEOUS SOLUTIONS. PARTICULAR REMARKS ON THE ACTION OF α RAYS. Marc Lefort (Laboratoire Curie, Paris). J. chim. phys. 51, 351-3(1954) July-Aug. (In French)

Alpha rays initiate chemical reactions in aqueous solutions which are different quantitatively and even qualitatively from those caused by x and γ rays. A systematic study of the production of H_2 in about 20 different solutions, irradiated with Po α particles, shows that yield remains constant at approximately $G_{H_2} = 1.8$ whatever the absorbed dose and solution is. On the contrary, the yield of H_2O_2 is variable and never attains that of H_2. Several possible hypotheses for explaining these results are discussed. (tr-auth)

581

INHIBITORY ACTION OF Cl IONS ON THE FORMATION OF HYDROGEN PEROXIDE BY THE α RAYS OF POLONIUM. M. C. Anta (Institut du Radium, Paris). J. chim. phys. 51, 401-2(1954) July-Aug. (In French)

H_2O_2 and mixtures of HCl and H_2SO_4 with an acidity constant of $0.8\underline{N}$ and Cl^- concentration varying between 0.01 and $0.8\underline{N}$ were irradiated with Po α rays. The yield of H_2O_2 decreases when the concentration of Cl^- increases. For Cl^- concentrations above $0.05\underline{N}$, no H_2O_2 is observed. Below that concentration the yield decreases with time. The H_2O_2 more than $0.1\underline{N}$ with Cl^- is completely destroyed by irradiation. (J.S.R.)

582

OXIDATION OF PHOSPHITES BY THE α RAYS OF POLONIUM. M. Cottin (Institut du Radium, Paris). J. chim. phys. 51, 404-5(1954) July-Aug. (In French)

The effect of Po α rays on phosphite solutions $0.8\underline{N}$ in H_2SO_4 was examined. In air the quantity of phosphate and H_2O_2 formed varies with the initial concentration of phosphite. H_2O_2 yield is small when the phosphite concentration is large. The sum of the yields $G_p + G_{H_2O_2}$ is constant. In deaerated solutions, the results are analogous, but the total yields are less. The variation of yield of H_2O_2 with the initial concentration of phosphite indicates that the reaction $HPO_3 + 2OH^- \rightarrow HPO_4 + H_2O$ is in competition with the reaction $2OH \rightarrow H_2O_2$. (J.S.R.)

RADIATION EFFECTS

583

KINETICS OF THE ETHYLENE REACTION INITIATED BY GAMMA RADIATION. James C. Hayward, Jr., and Randolph H. Bretton (Yale Univ., New Haven, Conn.). NUCLEAR ENGINEERING, PART III, Chem. Eng. Progr. Symposium Ser. No. 13, 73-88(1954)

Initial rates of the ethylene reaction initiated by gamma radiation have been derived from total pressure measurements on a batch system of ethylene subjected to a radiation intensity of about 100,000 r/hr. Initial rates from about 0.1 to 60% per day, and corresponding ion-pair yields from about 6 to 3300, were obtained at temperatures between 80 and 460°F and at pressures between $\frac{1}{2}$ and 21 atm. The reaction is homogeneous and is strongly inhibited by traces of oxygen. The product was generally a liquid; however, a white waxy solid was obtained at room temperature and the higher pressures. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

584

THE ANALYSIS OF INORGANIC COMPOUNDS BY PAPER CHROMATOGRAPHY. PART VI. FURTHER STUDIES ON THE SEPARATION AND DETECTION OF LANTHANONS. F. H. Pollard, J. F. W. McOmie, and H. M. Stevens (Univ. of Bristol, England). J. Chem. Soc., 3435-40(1954) Oct.

Tests for distinguishing between lanthanon groups and certain individual lanthanons are given. A number of substances were investigated for use in the preparation of complex-forming mobile phases and, of the latter, those consisting of 8-hydroxyquinoline in a n-butanol—water—acetic acid system yielded the best lanthanon separations. These appeared to depend on differences in ionic radii, with Y coming between Gd and Dy. Factors affecting the percentage yield of "didymium" from a mixture with cerium have been investigated, and successful separations between members of the cerium group and between this group and Y are described. Brief qualitative investigations suggested some resolution in two heavy-earth mixtures. (auth)

SEPARATION PROCEDURES

585

Hanford Works

THE MECHANISM OF URANIUM EXTRACTION BY TRIBUTYL PHOSPHATE. H. T. Hahn. July 20, 1954. 26p. Contract W-31-109-Eng-52. (HW-32626)

In order to determine the rate of extraction of uranium by tributyl phosphate as a function of both time and space coordinates, a glass cell was designed for the creation of a sharp interface between phases. A traversing mechanism used for photometric scanning of the diffusion cell is described. The rate of uranium transfer across the interface is initially greater than predicted solely by diffusion. This excess is largely removed in later stages, presumably by diffusion back to the interface. The source of this convective effect may be a relatively high-energy release upon complex formation. The uranium profile after 96 hr approaches that of a diffusion-controlled extraction. A surfactant is introduced to provide an interfacial impediment. The effect is experimentally observable. However, there is no evidence that such a barrier exists during the normal course of extraction. The amount of uranium extracted in 24-hr periods is found to be proportional to the

concentration of tributyl phosphate in Amsco. On the basis of a diffusion-controlled reaction the maximum rate of extraction is predicted to be that obtained in approximately 35% TBP—Amsco. Analytical solutions of the equations for combined diffusion and convection in a two-phase system are presented. (auth)

586

Ames Lab.

CAUSTIC TREATMENT OF ZIRCON SAND. G. H. Beyer, D. R. Spink, J. B. West, and H. A. Wilhelm. Aug. 17, 1954. 15p. Contract W-7405-eng-82. (ISC-437(rev.))

Caustic soda was found to be effective in decomposing zircon. Using a caustic-to-zircon weight ratio of 1.1:1 and a furnace temperature of 1050°F, it was found that 80 to 90% of the zircon reacted to form water-soluble sodium silicates and water-insoluble sodium zirconates. The zirconates were readily converted, after leaching with water, to high-purity zirconium compounds such as the oxychloride, fluoride, sulfate, hydroxide, oxide, and nitrate. The low caustic-to-zircon ratio and the simple equipment for decomposing the sand without previous grinding make this process convenient and economically attractive. (auth)

587

INTERLOCKING PLATE FOR CHARGING HIGH TEMPERATURE, PRESSURE DISSOLVER. F. L. Horn (Brookhaven National Lab., Upton, N. Y.). Nucleonics 12, No. 11, 75(1954) Nov.

The valves for charging a dissolver with reactor fuel slugs are interlocked to prevent error. A five-position selector sets the master plate at desired operating step. (M.P.G.)

588

A LOUVER-PLATE REDISTRIBUTOR FOR LARGE-DIAMETER PULSE COLUMNS. F. W. Woodfield and G. Sege (Hanford Atomic Products Operation, Richland, Wash.). NUCLEAR ENGINEERING, PART III, Chem. Eng. Progr. Symposium Ser. No. 13, 14-17(1954).

The development of a redistributor which improved liquid-liquid extraction performance in a large diameter pulse column by overcoming the adverse effects of channeling is described. The redistributor consists of a solid horizontal plate fitting snugly into the column and provided with louvers designed to swirl the column contents as they are pulsed. Under stated conditions such redistributors reduced the U in the raffinate (waste) stream from a 2-ft-diam pulse column, employed in solvent extraction of uranyl nitrate with tributyl phosphate, from 6 to 0.01% (or less) of the amount of U fed to the column. (auth)

589

RECENT DEVELOPMENTS IN PULSED-COLUMN TECHNIQUES. J. D. Thornton (Atomic Energy Research Establishment, Harwell, Berks, England). NUCLEAR ENGINEERING, PART III, Chem. Eng. Progr. Symposium Ser. No. 13, 39-52(1954).

A new method of air pulsing which eliminates bellows, diaphragms, and other moving parts in the liquid has also been developed. This consists in alternately compressing and expanding the air above a dip-tube which is open at the bottom and passes down the entire length of the column, either internally or externally. In the absence of solute, flooding data have been correlated by the following expressions, applicable also to other types of mechanical column contactors. $V_d = 2\bar{V} x_f^2(1-x_f)$, $V_d = \bar{V}(1-2x_f)(1-x_f)^2$. In these equations V_d and V_c are the superficial velocities of the dispersed and continuous phases, respectively, and x_f is the value of the fractional holdup at flooding. The characteristic droplet velocity, i.e., the mean droplet velocity at zero flow rates of the two phases is denoted by $\bar{V}$, which for any given system is a function only of the pulse and column characteristics. Preliminary mass transfer data for the water-toluene-acetone system have been interpreted in terms of the film values of the height of a transfer unit (H.T.U.). With columns of the present type where there is a high degree of turbulence in the continuous phase, $(H.T.U.)_c$ is very small and can be considered constant. Values for $(H.T.U.)_d$ for a given system appear to depend only upon the pulse and column characteristics and are independent of phase flow rates. (auth)

590

THE DESIGN PHILOSOPHY OF REMOTE OPERATION AND MAINTENANCE OF SEPARATIONS FACILITIES. W. M. Harty (Hanford Atomic Products Operation, Richland, Wash.). NUCLEAR ENGINEERING, PART III, Chem. Eng. Progr. Symposium Ser. No. 13, 115-21(1954).

This paper describes the philosophy used in the design of separations facilities by the General Electric Company at its Hanford Atomic Products Operation. It describes in general terms the chemical processes, equipment, and structures utilized in a separations plant, the arrangement of structures and equipment to provide remote operation and maintenance, and the economics and advantages of utilizing such a philosophy in design. (auth)

591

THE DEVELOPMENT OF RADIOCHEMICAL PROCESSES. C. M. Nicholls and A. S. White (Atomic Energy Research Establishment, Harwell, Berks, England). NUCLEAR ENGINEERING, PART III, Chem. Eng. Progr. Symposium Ser. No. 13, 129-38(1954).

A general discussion of the circumstances unusual to techniques required for the processing of nuclear fuels is presented. Plant facilities at Harwell are described. (K.S.)

592

THE AMES PROCESS FOR SEPARATION OF MONAZITE. M. Smutz, G. L. Bridger, K. G. Shaw, and M. E. Whatley (Iowa State Coll., Ames). NUCLEAR ENGINEERING, PART III, Chem. Eng. Progr. Symposium Ser. No. 13, 167-70(1954).

A flow process for the separation of rare earths, U, and Th from Indian, Brazilian, and Idaho monazites is described. The sand is digested by 93% H_2SO_4, Th is precipitated by addition of H_2O, and remaining constituents are precipitated by pH adjustment with NH_4OH. (K.S.)

593

SOME SEPARATIONS OF RADIOELEMENTS BY ION EXCHANGE. P. Radhakrishna (Laboratoire Curie, Paris). J. chim. phys. 51, 354-7(1954) July-Aug. (In French)

The conditions for the separation of Cu and Ra from Th by the use of ion exchange resin at high temperatures were studied. Po was separated from Bi at ordinary temperatures. (tr-auth)

594

THORIUM—ITS ESTIMATION AND SEPARATION FROM CERITE EARTHS—USE OF ARYLOXYACETIC ACIDS. N. Eswaranarayana and Bh. S. V. Raghava Rao (Andhara Univ., Waltair, India). J. Sci. Ind. Research (India) 13, 657-9(1954) Nov.

The use of o-chloro-phenoxy acetic acid, p-chloro-phenoxy acetic acid, and p-chloro-m-cresoxy acetic acid as

precipitating agents for thoria in the separation of thorium from cerite earths has been investigated. The optimum pH for precipitation with these reagents is between 2.5 and 3.6. If the concentration of rare earths is more than three times that of thoria, a double precipitation is necessary. As little as 3.5 mg of thoria can be estimated. Of the three reagents, p-chloro-phenoxy acetic acid is the most effective. (auth)

SORPTION PHENOMENA

595

THE APPARENT ABSORPTION OF SOME ALIPHATIC COMPOUNDS FROM AQUEOUS SOLUTIONS AS INFERRED FROM HYDROGEN OVERVOLTAGE MEASUREMENTS. Robert S. Hansen and Bert H. Clampitt (Iowa State Coll., Ames). J. Phys. Chem. 58, 908-11(1954).

Apparent isotherms for the absorption of a number of organic compounds from aqueous solution by silver and copper were measured by double layer capacitance and steady state current-overvoltage techniques. Apparent surface coverages inferred from double layer capacitance changes and from overvoltage changes at several currents were found to be in reasonably good agreement. Results for slightly soluble adsorbates appear reasonable in order of magnitude but may be slightly low due to coreduction of, or hydrogen discharge through, the adsorbed layer. In the case of highly soluble adsorbates, care must be taken to correct for change in reversible cell potential. (auth)

SYNTHESES

596

Virginia Polytechnic Inst.
ELECTROCHEMICAL PREPARATION OF BORON. N. F. Murphy, R. S. Tinsley, and G. F. Meenaghan. Nov. 25, 1954. 12p. For [Callery Chemical Co. Contract NOa(s)-52-1024C]. (CCC-1024-TR-76)

A new process for preparing boron by electrolysis of molten alkali oxide—alkali borofluoride—boron oxide mixture, at 750° to 875°C, from 0.5 to 5.0 cathode amperes per square cm is described. Either potassium or sodium salts with a steel cathode and graphite anode may be used. The only appreciable impurity that was observed when optimum conditions were used was carbon (about two per cent) which resulted from decrepitation of the graphite crucible and anodes. The current efficiency for the process depended on conditions, and ranged up to 73 per cent. A gas fired furnace was used to avoid corrosion of resistance elements by fumes. (auth)

597

Syracuse Univ.
ATTEMPTED SYNTHESIS OF HETEROCYCLIC COMPOUNDS OF BORON. FINAL REPORT. Richard D. Sands. June 1954. 25p. [For Mathieson Chemical Corp., Contract NOa (s) 52-1023 c]. (MCC-1023-TR-75)

The following specific reactions were investigated: the reaction of boron trifluoride etherate with the di-Grignard prepared from pentamethylene bromide; the reaction of boron trifluoride in ethyl and n-butyl ether and in tetrahydrofuran with the di-Grignard prepared from tetramethylene bromide; the reaction of n-amyldifluoroborine and the di-Grignard prepared from pentamethylene bromide; and the preparation of tetrahydropyran-4-car carboxylic acid, a key intermediate in the route to 1-borabicyclo(2,2,2)octane. (auth)

598

Rennselaer Polytechnic Inst.
BORON TRIHALIDES FROM FUSED SALTS. John H. Wood and Chester Zabielski. Sept. 1954. 28p. [For Mathieson Chemical Corp., Contract NOa(s)-52-1023-c]. (MCC-1023-TR-80)

The reaction of alkali metal and alkaline earth halides with boric oxide at 800 to 1000°C according to the reaction $B_2O_3 + MX \rightarrow BX_3 + M_2O \cdot aB_2O_3$ has been studied. It has been found that the alkali metal salts are more satisfactory that those of the alkaline earths. The yields with lithium, sodium, and potassium are a function of the alkali metal used and the salt to boric oxide ratio and are independent of the halide used. The decreasing order of efficiency is lithium, sodium, and potassium. The yields are a linear function of the boric oxide ratio, being highest for high B_2O_3 content. The yields of BX_3, on a halide basis, are 85, 60, and 40% for a 3:1 ratio of B_2O_3 to MX, and 50, 30, and 20% for a 1:1 ratio for lithium, sodium, and potassium halides, respectively. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

599

MAGNETOCHEMISTRY OF THE HEAVIEST ELEMENTS. PART VIII. METALLIC PLUTONIUM. J. K. Dawson (Atomic Energy Research Establishment, Harwell, Berks, England). J. Chem. Soc., 3393-6(1954) Oct.

The magnetic susceptibility of metallic plutonium was measured up to 350°C. Indications of structure transitions were observed at 119, 205, and about 300°. The susceptibility of two samples was almost independent of temperature and had the value 2.52×10^{-6}/g at 20° for the purest sample. A third sample showed a marked decrease of susceptibility with increase of temperature. (auth)

URANIUM AND URANIUM COMPOUNDS

600

Chemical Research Lab., Metal Hydrides, Inc.
URANIUM HYDRIDE AND THE URANIUM—HYDROGEN SYSTEM. SIXTH TOPICAL REPORT. Thomas R. P. Gibb, Jr., Henry W. Kruschwitz, Jr., and James J. M McSharry, Mar. 21, 1951. 18p. For NEPA Div., Fairchild Engine and Airplane Corp., Contract [W33-08-ac-14801 (16250)], Subcontract SC-2026. (NEPA-1798)

Work on the dissociation pressure of U hydride in the range 300 to 625°C is reported. The data indicate a straight line relation between the logarithm of the dissociation pressure and the reciprocal of the absolute temperature. The slope of the curves and the magnitude of the pressure at a given temperature depend on the U to hydrogen ratio in the solid phase. Above 357°C some anomalous departures from the conclusion that equilibrium pressure is not a function of composition over a wide range of compositions are noted. The pyrophoricity of U hydride was found to be profoundly affected by exposure to A containing traces of air or moisture. Compacts of U hydride prepared at the maximum commercially attainable pressures had a density of only 80% of theoretical. The overall H_2 density of U hydride contained in a cylindrical vessel of sufficient thickness to withstand the required internal pressure was calculated as a function of pressure and temperature. (J.S.R.)

601

A PROCESS FOR RECOVERY OF URANIUM FROM PITCH-BLENDE DIGESTION RESIDUES. G. E. Brown and C. W. Kuhlman, Jr. (Mallinckrodt Chemical Works, St. Louis, Mo.). NUCLEAR ENGINEERING, PART III, Chem. Eng. Progr. Symposium Ser. No. 13, 5-10(1954).

A possible process for the recovery of insoluble uranium present in residues from nitric acid digestions of pitch-blende is presented. This process is based on dissolution of the acid-insoluble compound, identified to be chiefly a uranyl molybdate, in a sodium carbonate solution. Uranium is then removed from this carbonate system by precipitation with sodium hydroxide. This process effects a separation of most of the molybdenum from the associated uranium. Pilot plant and laboratory investigations of this process revealed the following important operational variables: the efficiency of uranium removal from the residue cake was found to vary inversely with the total uranium present in the residue from the pitchblende digestion; the presence of bicarbonate in addition to carbonate ion in the liquors used for leaching was found to result in a more effective leach than the use of a sodium carbonate solution alone; carbonate-bicarbonate liquors containing high concentrations of sodium sulfate and/or sodium nitrate were considerably less effective as leaching agents than fresh solutions; owing to the physical characteristics of these residue cakes, a decantation wash technique was necessary to remove the solubilized uranium. On the basis of the above a continuous countercurrent extraction system was designed. A flow sheet and a description of process engineering are presented. (auth)

602

THE OXIDES OF URANIUM. PART IV. THE SYSTEM $UO_2 - ThO_2 - O$. J. S. Anderson, D. N. Edgington, L. E. J. Roberts, and E. Wait (Atomic Energy Research Establishment, Harwell, Berks, England). J. Chem. Soc., 3324-31 (1954) Oct.

Several mixed crystals having the general formula $U_xTh_{1-x}O_2$ were oxidized at temperatures of 100 to 1000°. Oxidation under appropriate conditions yielded cubic phases; no other structures were formed when x <0.5. The densities of the cubic oxidized phases showed that oxygen entered interstitial positions in the original lattice. When x >0.5, the amount of interstitial oxygen that could be accommodated was limited to 1.4 atoms per unit cell. When x <0.5, the concentration of interstitial oxygen came to a reversible equilibrium with the ambient oxygen pressure at high temperatures. The unit cell contracted as the average uranium valency increased from 4.0 to 5.0 and began to expand as the uranium valency increased from 5.0 to 5.5. This result indicates that isolated uranium cations with more than 5 positive charges cannot exist in these crystals. (auth)

603

THE OXIDES OF URANIUM. PART V. THE CHEMISORPTION OF OXYGEN ON UO_2 AND ON $UO_2 - ThO_2$ SOLID SOLUTIONS. L. E. J. Roberts (Atomic Energy Research Establishment, Harwell, Berks, England). J. Chem. Soc., 3332-9(1954) Oct.

Oxygen is rapidly chemisorbed by freshly reduced surfaces of uranium dioxide at −183°, and also by surfaces of mixed crystals of uranium dioxide and thorium dioxide if these surfaces are prepared by crushing macrocrystalline samples. One oxygen molecule reacts with a single U^{4+} site

in the primary act of chemisorption. At least half the U^{4+} ions in the surface layers react with oxygen, and only about 30% of the occupied sites become vacant on high-temperature evacuation. There is evidence that Th^{4+} ions concentrate preferentially in the surface layers of some mixed-crystal preparations. (auth)

WASTE DISPOSAL

604

RADIOACTIVE-WASTE DISPOSAL IN THE OCEAN. Natl. Bur. Standards (U. S.) Handbook 58, Aug. 1954. 31p. $0.20.

Recommendations of the National Committee on Radiation Protection governing radioactive-waste disposal in the ocean are presented. Factors affecting safety and convenience are discussed. (C. H.)

ENGINEERING

605

Mine Safety Appliances Co.
SODIUM LEAK DETECTION IN VERTICAL PIPING. W. Milich and E. C. King. Nov. 19, 1954. 22p. Contract NObs-65426, Technical Report No. 34. (NP-5417)

The leak detecting tape previously developed for application on horizontal piping operated satisfactorily for leaking sodium at 850°F and 80 psig. At 350°F and 50 psig the tape was not satisfactory for use on vertical or horizontal piping. It has been shown that the tape can be used for 350°F, 50-psig sodium leak detection on vertical piping, provided sumps are cut into the insulation at the nearest horizontal section. The leaking sodium collects in the sumps and shorts out bare wires set in ceramic spacers. Bare wires in 2-hole ceramic spacers have been tested and recommended instead of the woven electrical insulation leak detector tape. A leak in vertical pipe was not satisfactorily detected until the sodium reached a bend and horizontal pipe section. (auth)

606

GENERAL-PURPOSE OVERHEAD MANIPULATOR. L. G. Gitzendanner, W. A. Hartman, G. H. Sittner, and H. M. Steven (General Electric Company, Schenectady, N. Y.). NUCLEAR ENGINEERING, PART III, Chem. Eng. Progr. Symposium Ser. No. 13, 18-26(1954).

The function and design features of a new mechanical arm which was designed and built by the General Engineering Laboratory, General Electric Company is described. It was built for use in research and development for nuclear propulsion as an aid in the assembly of equipment in a radioactive area. This machine, called the overhead manipulator, or O-Man, may be used alone in the assembly or disassembly of equipment or may be used in conjunction with cranes and other handling equipment in the movement and manipulation of parts. This device is capable of applying a force of 500 lb in its least favorable position and lifting and manipulating loads up to 5000 lb. Its motions follow rectilinear coordinates and are controlled electrically from consoles located in a safe area, and its configuration is similar to smaller mechanical manipulators, having an upper arm, forearm, wrist, and hand. It operates from a crane bridge through a vertical range of 25 ft. Design features include amplidyne control, elimination of slip rings, and radiation resistant materials. (auth)

AEROSOLS

607

PORTABLE ELECTROSTATIC DUST SAMPLER WITH
ELECTRONIC AIR FLOW. D. G. Beadle, P. H. Kitto, and
P. J. Blignaut (Johannesburg, Transvaal, South Africa).
Arch. Ind. Hyg. and Occupational Med. 10, 381-9(1954) Nov.

A portable electrostatic dust sampler is described.
Operating either from electric mains or from six small
batteries, it can sample, with satisfactorily high efficiency
at 100 cfm or more for 12 to 15 hours. If air velocities are
very low, its own electric wind will give a minimum air flow
of 40 cfm past the collecting plates. It meets the need for a
dust sampler able to collect in a reasonable time sufficient
air-borne dust for x-ray or chemical analysis. The total
weight of the apparatus is 42 lb. (auth)

HEAT TRANSFER AND FLUID FLOW

608

Argonne National Lab.
PYROLYTIC REACTIONS OF DIPHENYL UNDER HIGH
HEAT FLUX CONDITIONS. Kermit Anderson. Aug. 19,
1954. 35p. Contract W-31-109-eng-38. (ANL-5304)

The thermal stability of diphenyl at high heat fluxes and
at a bulk temperature of 600°F has been investigated in a
dynamic test loop, helium pressurized to approximately
200 psig. Diphenyl, held at 600°F, was pumped through a
reaction chamber past Nichrome ribbon heating elements
having a calculated surface temperature of approximately
788°F. No carbon deposit was observed on individual
ribbons after continuous operation at a heat flux of 292,000
Btu/(hr)(sq ft) for either 36 or 145 hr. Analyses of
samples indicated approximately 10% pyrolytic conversion
of diphenyl to other hydrocarbon materials, probably
higher polyphenyls. (auth)

609

General Engineering Lab., General Electric Co.
THERMAL STRESSES IN HOLLOW CYLINDERS. R. A.
Powell and H. Poritsky. Oct. 22, 1954. 51p. For Hanford
Works Contract [W-31-109-Eng-52]. (GEL-90; R54GL269)

The temperature distribution is obtained in a hollow
cylinder in which heat is generated at a uniform constant
rate and which is cooled internally. The thermal stress
distribution under these conditions is then obtained first
for an infinitely long cylinder, then for a cylinder of
finite axial length. Application of the method to the case
of both external and internal cooling is described. (auth)

RADIOGRAPHY

610

RADIOGRAPHY AS A HOT-LAB SERVICE. J. C. Austin
and P. Richards (Brookhaven National Lab., Upton, N. Y.).
Nucleonics 12, No. 11, 78-9(1954) Nov.

Radiographic service performed by a hot lab is described.
The apparatus employed, results obtained, and advantages
of the service are discussed. (M.P.G.)

TRACER APPLICATIONS

611

GROWTH OF RADIOISOTOPE UTILIZATION IN INDUSTRY
AND ENGINEERING. Paul C. Aebersold and Charles E.
Crompton (U. S. Atomic Energy Commission, Oak Ridge,
Tenn.). NUCLEAR ENGINEERING, PART III, Chem. Eng.
Progr. Symposium Ser. No. 13, 105-14(1954).

The utilization of radioisotopes in engineering and in-
dustrial processes is illustrated by a discussion of specific
applications. These include problems associated with high-
speed packaging, access and sampling, thickness gauges,
analytical chemistry, and quality control. (K.S.)

612

RADIOISOTOPES IN INDUSTRY. Henry Seligman (Atomic
Energy Research Establishment, Harwell, Berks, England).
Atomics 5, 299-302;318(1954) Nov.

Some of the industrial applications of radioisotopes are
summarized, and recent developments are described. (M.P.G.)

613

THE USE OF RADIOACTIVE ISOTOPES IN TRACING SEW-
AGE FLOW. G. A. Truesdale (Water Pollution Research
Lab., Stevenage, Herts, England). Atomics 5, 304-12(1954)
Nov.

Experiments are described in which Rb^{86} was used to
trace the flow of sewage through sedimentation tanks and
percolating filters. (M.P.G.)

VACUUM SYSTEMS

614

SEAL-OFF VALVE FOR VACUUM SYSTEMS. National
Bureau of Standards. J. Franklin Inst. 25, 401-3(1954) Nov.

A seal-off valve for vacuum systems designed so that its
handle and stem can be readily removed and used with any
number of seal-off seats leaving only the closed valve seat
on the evacuated apparatus is discussed. The device is also
well adapted to use as a pressure seal or as a combination
safety valve and seal-off valve. The valve provides a
permanent pumping tap that can be used many times with
soldering or welding. The parts can be made of any suitable
material, but a neoprene seat is recommended for use on
high-vacuum systems. (J.A.G.)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

615

Illinois Univ.
AN INVESTIGATION OF THE GAS PERMEABILITY OF
BASE COAT GLASSES. REPORT NO. 35. Dwight G.
Bennett. Mar. 1949. 28p. Contract W33-038-ac-
14520(16071). (ATI-58116)

616

ATI-58194
Illinois Univ.
AN INVESTIGATION OF THE GAS PERMEABILITY OF
BASE COAT GLASSES. REPORT NO. 40. Dwight G.
Bennett and Terry F. Newkirk. June 1949. 16p.
Contract W33-038-ac-14520(16071). (ATI-58194)

617

DECONTAMINATION CHARACTERISTICS OF PORCELAIN
ENAMEL. G. W. Parker and G. M. Herbert (Oak Ridge
National Lab., Tenn.). Nucleonics 12, No. 11, 72-4(1954) Nov.

The radiochemical decontamination characteristics of
porcelain enameled steel were compared with those of other
common laboratory materials. The methods used in the
comparison are described, and tables of results are given.
The best porcelains equalled glass and stainless steel in
susceptibility and decontaminability. (M.P.G.)

CORROSION

618

Argonne National Lab.
EDDY CURRENT TYPE DIAMETER GAUGE FOR CORROSION MEASUREMENTS. William B. Doe. [Sept. 1954] 16p. Contract W-31-109-eng-38. (ANL-5227)

An eddy current type instrument, which will detect one ten millionth inch change in the radius of a metal rod, is described. This sensitivity was required to determine the corrosion rates of corrosion-resistant metals without an unduly long corrosion period. Surface oxide films do not interfere with the measurements. (auth)

619

Los Alamos Scientific Lab.
MATHEMATICAL ANALYSIS OF GALVANIC CORROSION. PART 1: POTENTIAL EVALUATIONS FOR COPLANAR ELECTRODES WITH ONE ELECTRODE INFINITELY LARGE AND WITH EQUAL POLARIZATION PARAMETERS. James T. Waber and Marshall Rosenbluth. Apr. 1954. 21p. Contract W-7405-eng-36. (LA-1651)

The distribution of potential within the electrolyte and at the electrode interface has been derived and numerically evaluated. The model of a galvanic cell used assumed that one electrode was infinitely large in comparison with the other and assumed the ideal condition that the polarization parameter, as defined by Wagner, was equal for both electrodes. Potential values are tabulated for three values of the reduced distance parameter. (auth)

620

Los Alamos Scientific Lab.
MATHEMATICAL ANALYSIS OF GALVANIC CORROSION. PART 3. EFFECT OF POLARIZATION ON THE POTENTIAL DISTRIBUTION EVALUATED FOR FINITE COPLANAR ELECTRODES. James T. Waber, Allan I. Benson, and Max Goldstein. May 1954. 21p. Contract W-7405-eng-36. (LA-1668)

The detailed distribution of potential over the coplanar electrodes and throughout the electrolyte contiguous to them is discussed. The geometric arrangement of electrodes is shown. The electrodes are assumed to polarize similarly so that the polarization parameter is equal on the anodic and cathodic surfaces. (auth)

GEOLOGY AND MINERALOGY

621

Pennsylvania State Coll. Mineral Industries Experiment Station
AN INVESTIGATION OF THE MINERALOGY, PETROGRAPHY AND PALEOBOTANY OF URANIUM-BEARING SHALES AND LIGNITES. (SCOPE A—SHALES). QUARTERLY PROGRESS REPORT [FOR] PERIOD OF APRIL 1, 1953 TO JUNE 30, 1953. Thomas F. Bates, Harold D. Wright, Elena Camilli, Eugene Silverman, Erwin Strahl, and Lois Weiser. July 22, 1953. 35p. Contract AT(30-1)-1202. (NYO-3365)

X-ray analysis has shown the main constituents of twelve samples of the Chattanooga Bentonite to be quartz, kaolinite, and mica. In several cases the mica is megascopically visible as brown flakes. A microscopic study of these samples has shown a color variation of the mica flakes from dark brown to nearly colorless and a related variation in optical properties. Combines x-ray and petrographic data suggest the degradation of brown mica to clay. A flow sheet

has been compiled showing the analytical scheme being used for evaluation of the core samples. Due to the nature of the shale, several modifications have been made in the existing procedures. A number of experiments have been carried out in order to calibrate the fluorimeter and to standardize a working procedure. Because of the poor precision of the results, various tests were run in order to determine what phases of the technique were causing the variation. (auth)

622

Pennsylvania State Coll. Mineral Industries Experiment Station
AN INVESTIGATION OF THE MINERALOGY, PETROGRAPHY AND PALEOBOTANY OF URANIUM-BEARING SHALES AND LIGNITES. (SCOPE B—LIGNITES). QUARTERLY PROGRESS REPORT [FOR] PERIOD OF APRIL 1, 1953 TO JUNE 30, 1953. E. F. Koppe, E. Erickson, C. L. Trotter, W. Spackman, and T. F. Bates. July 1, 1953. 26p. Contract AT(30-1)-1202. (NYO-3366)

A petrographic and palynologic examination was made of the second and third lignite seams exposed at the Mendenhall stripping site in Harding Co., S. Dak. In addition to the results obtained, x-ray studies of the clays and silts found associated with the lignites are discussed. (J.E.D.)

623

Massachusetts Inst. of Tech.
THE ADAPTATION OF NEW RESEARCH TECHNIQUES TO MINERAL ENGINEERING PROBLEMS. PROGRESS REPORT. Oct. 31, 1954. 39p. Contract AT(30-1)-956. (NYO-6262; MITS-25)

Adsorption measurements of Ag^+ and I^- on AgI in the absence and presence of lauric acid were made at pH 6 and at an ionic strength of 10^{-2}. Surface area measurements were made with the krypton apparatus. Sodium adsorption tests were made on quartz at a total ionic strength of 0.1 mole/l and at a pH of 2 and 3. The adsorption of Cu on sphalerite was measured as a function of the concentration of ammonia in solutions containing a fixed amount of Cu. Streaming potential studies on corundum in solutions of HCl and NaCl were made, and the results are graphed. The solubility products of the Zn^{+2}, Pb^{+2}, Ag^+, and Cu^{+2} salts of ethyl xanthic acid were determined by the conductometric and potentiometric method. A number of grinding tests were carried out on quartz in the vibratory ball mill. A test made with the centrifugal elutriator attempted a size separation at approximately 2μ, and the classifying operation was 80.7% efficient. A rapid turbidimetric method for determining relative specific surfaces was developed. (For preceding period see NYO-6260.) (J.S.R.)

624

Grand Junction Operations Office, AEC
A STATISTICAL ANALYSIS OF CONTRACT DRILLING ON THE COLORADO PLATEAU. John P. Kellogg. July 29, 1954. 18p. (RME-4058)

625

THE POTASSIUM-ARGON METHOD OF GEOLOGICAL AGE DETERMINATION. H. A. Shillibeer and R. D. Russell (Univ. of Toronto, Ontario, Canada). Can. J. Phys. 32, 681-93(1954) Nov.

The development of the potassium-argon method for dating minerals is discussed. The decay scheme of radioactive potassium-40 is examined. The results of 11 recent counting experiments have been averaged and give a mean value of 29.4 ± 2.7 beta emissions per second per gram of potas-

sium. Averaging the 15 previous determinations of the rate of gamma decay gives a branching ratio of 0.090 ± 0.038 with the above beta decay rate. This is in close agreement with a branching ratio of 0.089 suggested by us in a previous paper on the basis of two potassium-argon determinations. Methods of measuring the radiogenic argon content of potassium minerals are discussed and the method in use at this laboratory is described in detail. Yield runs and grain size experiments have been carried out and are reported. Potassium-argon ages have been calculated for four perthites and two lepidolites. These ages are in excellent agreement with the best available ages obtained by other methods. (auth)

526

VARIATIONS IN THE ISOTOPIC ABUNDANCES OF NEON AND ARGON EXTRACTED FROM RADIOACTIVE MINERALS. George W. Wetherill (Argonne National Lab., Lemont, Ill.). Phys. Rev. 96, 679-83(1954) Nov. 1.

Large excesses of Ne^{21}, Ne^{22}, and A^{38} have been found in uranium and thorium minerals. These abnormal abundances are ascribed to (α, n) and (α, p) reactions in the minerals. It is shown that it is possible that a part of the atmospheric Ne^{21} originated in this way. (auth)

627

SUMMARY OF INVESTIGATIONS OF URANIUM DEPOSITS IN THE PUMPKIN BUTTES AREA: JOHNSON AND CAMPBELL COUNTIES, WYOMING. Max L. Troyer, Edward J. McKay, Paul E. Soister, and Stewart R. Wallace (U. S. Geological Survey, Washington, D. C.). U. S. Geol. Survey Circ. 338, 1954. 17p.

Uranium minerals were discovered in the Pumpkin Buttes area, Campbell and Johnson Counties, Wyo., by the U. S. Geological Survey in October 1951. From June to November 1952, an area of about 750 square miles was examined for uranium deposits, and 211 localities having abnormally high radioactivity were found; uranium minerals are visible at 121 of these localities. All known uranium mineralization in the area is restricted to sandstones of the Wasatch formation, except sparsely disseminated uranium in the sandstone of the White River formation, which caps the Pumpkin Buttes, and several localities on the Great Pine Ridge southwest of the Pumpkin Buttes where iron-saturated sandstone and clinker in the Fort Union formation have above-normal radioactivity. The uranium occurrences in the Wasatch formation are in a red sandstone zone 450 to 900 feet above the base of the formation and are of two types: small concretionary masses of uranium, iron, manganese and vanadium minerals in sandstone, and irregular zones in which uranium minerals are disseminated in sandstone. The second type is usually larger but of lower grade than the first. Most of the localities at which uranium occurs are in a north-trending belt about 60 miles long and 18 miles in maximum width. (auth)

628

RECONNAISSANCE FOR RADIOACTIVE DEPOSITS IN EASTERN ALASKA 1952. Arthur E. Nelson, Walter S. West, and John J. Matzko (U. S. Geological Survey, Washington, D. C.). U. S. Geol. Survey Circ. 348, 1954. 21p.

Reconnaissance for radioactive deposits was conducted in selected areas of eastern Alaska during 1952. Examination of copper, silver, and molybdenum occurrences and of a reported nickel prospect in the Slana-Nabesna and Chisana districts in the eastern Alaska Range revealed a maximum radioactivity of about 0.003 percent equivalent uranium. No appreciable radioactivity anomalies were indicated by aerial and foot traverses in the area. Reconnaissance for possible lode concentrations of uranium minerals in the vicinity of reported fluorite occurrences in the Hope Creek and Miller House-Circle Hot Springs areas of the Circle quadrangle and in the Fortymile district revealed a maximum of 0.055 percent equivalent uranium in a float fragment of ferruginous breccia in the Hope Creek area; analysis of samples obtained in the vicinity of the other fluorite occurrences showed a maximum of only 0.005 percent equivalent uranium. No uraniferous lodes were discovered in the Koyukuk-Chandalar region, nor was the source of the monazite, previously reported in the placer concentrates from the Chandalar mining district, located. The source of the uranothorianite in the placers at Gold Bench on the South Fork of the Koyukuk River was not found during a brief reconnaissance, but a placer concentrate containing 0.18 percent equivalent uranium was obtained. This concentrate is about 10 times more radioactive than concentrates previously available from the area. (auth)

METALS AND METALLURGY

629

Hanford Works

PRODUCTION OF NITROGEN DIOXIDE DURING HELIARC WELDING IN AN ATMOSPHERE OF NITROGEN. W. E. Gill. Aug. 10, 1953. 3p. Contract W-31-109-Eng-52. (HW-29071(rev.))

The concentrations of nitrogen dioxide found in six samples collected in the effluent gas downstream from the welding operation were ranged from 0 to 7 ppm. The concentration of nitrogen dioxide in the atmosphere on the outside of the tube during completion of the weld after the joint had been sealed is shown. These concentrations were so low that they did not constitute a health hazard. (auth)

630

Jet Propulsion Lab., Calif. Inst. of Tech.

A PRELIMINARY INVESTIGATION OF DIFFUSION IN ZIRCONIUM. PROGRESS REPORT. H. L. Wheeler, Jr. Apr. 8, 1952. 14p. Contract DA-04-495-ord-18. (JPL-PR-20-172)

Tracer techniques were applied to studies of diffusion in Zr. Methods for diffusion measurements are discussed, the equipment used is described, and the principal sources of errors are considered. The Matano method was employed to obtain the values of the diffusion coefficient from the activity distribution curves for Zr-Ti and Zr-Zr couples. (C.H.)

631

North American Aviation, Inc.

A REMOTELY CONTROLLED WELDING DEVICE FOR JOINING STAINLESS STEEL TUBES. Martin Mueller and Eugene Hecker. Nov. 15, 1954. 33p. Contract At-11-1-GEN-8. (NAA-SR-1014)

The design and testing of experimental equipment for remotely joining stainless steel tubing by heliarc welding is described. This apparatus consists of a modified heliarc welding torch which is hydraulically controlled to maintain constant arc voltage. A suitable arc voltage sensing and control amplifier circuit was developed for this application. (auth)

632

Works Control Lab., Babcock and Wilcox Co.
INVESTIGATION OF EXPERIMENTAL 14″ I. D. HEAT
EXCHANGER. [JOB] AEJ-4]. REPORT NO. 278, SUPPLE-
MENT NO. 1. O. R. Carpenter. Aug. 18, 1953. 21p.
Includes Appendix: [WL Spec NO. W312N. PROCEDURE
SPECIFICATIONS FOR EXPANDING AND METAL ARC
WELDING ½″ × .054″ TYPE 347 TUBES TO 7″ THICK
TYPE 347 TUBE SHEET. JOB AEJ-4]. (NP-5295(suppl.
1))

Problems encountered in the welding of small-diameter
tubes to a tube sheet in the fabrication of a model heat
exchanger are discussed. Procedures were studied for
improving the welds, and recommendations are presented
for adoption of an improved procedure. Specifications for
the procedure for expanding and metal arc welding of the
tubes to the tube sheet are presented in an appendix. (C.H.)

633

Battelle Memorial Inst.
A METALLURGICAL STUDY OF MOLYBDENUM. [FINAL]
SUMMARY REPORT. S. L. Case. Oct 15, 1954. 110p.
Contract [N9onr-82100, T. O. 1]. (NP-5420)

A metallurgical study of Mo is presented on the following
major problems: improvement in room-temperature
ductility of Mo with heat treatment; impurity effects,
testing procedures, preparations, analytical methods, arc-
melting, purification, and weldments; measurement of
high-temperature creep-rupture strength of Mo and Mo
alloys; and oxidation of Mo and Mo binary and ternary
alloys. (J.A.G.)

634

Dynamic Properties Lab., Calif. Inst. of Tech.
THE INITIATION OF DISCONTINUOUS YIELDING IN
DUCTILE MOLYBDENUM. J. A. Hendrickson, D. S. Wood,
and D. S. Clark. Oct. 1954. 52p. Contract N6onr-
24418, Technical Report No. 9. (NP-5422)

The results of an experimental investigation of the
initiation of yielding in fine grained ductile molybdenum
under rapidly applied constant stress are presented. Two
lots of material, one produced by arc-casting and the other
by powder metallurgy methods, were investigated. The
results show that both materials exhibit the phenomenon of
delayed yielding as well as distinct yield points in their
static stress-strain relations. The delay time for yielding
was determined as a function of stress at temperatures of
-74, +76, and +200°F, and measurements of pre-yield
plastic strain were obtained. The stress vs. delay time
relations obtained do not exhibit a lower limiting stress
(constant stress portion at low stress and long delay time)
such as that exhibited in normal low carbon steel. This
behavior of the molybdenum is attributed to the rather low
concentrations of carbon and nitrogen in the material tested
and is consistent with the previously observed behavior of
steel containing comparably low concentrations of these
elements. An upper limiting stress (constant stress portion
at high stress and short delay time) is observed in one of
the stress vs. delay time relations found for molybdenum.
For a given general range of delay times this is observed
at a higher temperature than that at which the same be-
havior has been found in steel in previous investigations.
This result is consistent with the higher melting point and
higher ductile to brittle transition temperature of
molybdenum as compared to iron. These results, together
with others obtained in this investigation, indicate that the

mechanism of the initiation of yielding in ductile molybde-
num is substantially the same as for annealed low carbon
steel. This lends further support to the dislocation theory
of yield point phenomena which is based largely upon the
concept of the anchoring of dislocations in body-centered
cubic metals by interstitial solute atoms such as carbon
and nitrogen. (auth)

635

Naval Research Lab.
THERMAL AND RELATED PHYSICAL PROPERTIES OF
MOLTEN MATERIALS. PROGRESS REPORT NO. 10
[FOR] PERIOD MAY 1 TO JULY 31, 1954. B. E. Walker,
C. T. Ewing, and D. D. Willaims. Nov. 1, 1954. 10p.
(NRL-Memo-387)

The heat content and heat capacity has been measured on
solid and liquid salt "A" (LiF−KF−NaF). These measure-
ments have been made from 100° to 440°C on the solid and
from 480° to 875°C on the liquid. The values are given over
the range along with equations for calculating the values
with suitable accuracy. Monel metal has been used to make
containers for thermal conductivity measurements on the
salts. A uniaxial heat flow method will be used on salt "A"
and a cylindrical type for salt "B" and lower conductivity
salts. (For preceding period see NRL-Memo-312.) (auth)

636

Tufts Coll.
TRANSITION-METAL HYDRIDES. STATUS OF WORK ON
THE PREPARATION OF IRON, NICKEL, AND MANGANESE
HYDRIDES. PROGRESS REPORT FOR YEAR ENDING
JUNE 1, 1954. M. John Rice, Jr. and Thomas R. P. Gibb,
Jr. June 15, 1954. 15p. Contract AT(30-1)-1355, Scope
11. (NYO-3917)

Experiments on the attempted preparation of iron-group
hydrides by metathetical reaction of the halides with
aluminum hydride in ether solution are described. The
reaction of metals with atomic hydrogen in a discharge
tube is reported. Significant absorption of hydrogen is
noted only in the case of metals which also combine with
molecular hydrogen. A brief preliminary discussion of
several factors bearing on iron-group hydrides is given.
(auth)

637

Pittsburgh Univ.
APPLICATION OF CHEMICAL THERMODYNAMICS TO
THE STUDY OF ALLOY FORMATION. PROGRESS
REPORT FOR JULY 1, 1954 TO OCTOBER 1, 1954. W. E.
Wallace, R. S. Craig, T. D. Brotherton, W. V. Johnston,
S. Kamath, and C. A. Krier. Oct. 14, 1954. 11p.
Contract AT(30-1)-647. (NYO-6323)

Additional measurements were made of the electrical and
thermal conductivities of Cd in the vicinity of 225°K. X-ray
studies of ordering in Mg−Cd alloys are reported. (For
preceding period see NYO-6322.) (L.T.W.)

638

Forrestal Research Center, Princeton Univ.
KINETICS OF FORMATION OF POROUS OF PARTIALLY
DETACHED SCALES. METALLURGY REPORT NO. 1.
C. E. Birchenall. July 1954. 11p. Contract AF18(600)-
967. (OSR-TN-54-286)

The variety of kinetic relations which may be found for
the oxidation of solid metals when porosity forms in the
oxide or at the metal−oxide interface according to several
systematic procedures is examined. Particular attention is
given to the time to the time sequence in which various rate

laws may govern the process. The need for more careful correlation of microstructures with rate measurements is emphasized. The possible role of plastic deformation is also considered. (auth)

639

Engineering Research Inst., Univ. of Mich.
EVALUSTION OF TITANIUM AND TITANIUM ALLOYS. SPECTROCHEMICAL ANALYSIS OF TITANIUM METAL AND ALLOYS. FINAL REPORT. J. H. Enns. July 1954. 24p. Contract DA-20-018-ORD-11511. (WAL-401/98-37)

A study was made of spectrochemical methods for the analysis of Ti and Ti alloys, including the determination of Fe and V in concentrations of about 2.5% by the porous-cup technique, porous-cup determination of B below 0.1%, a-c arc excitation with the porous-cup technique, and analysis of Ti metals by direct sparking. (J.E.D.)

640

PHYSICO-CHEMICAL PRINCIPLES OF THE PRODUCTION OF FERROALLOYS. V. P. Elyutin and B. E. Levin. Translated from Stal 7, 903-10(1947). 27p. Available from Henry Brutcher (Trans. No. 3405), Altadena, Calif. (AEC-tr-1973)

641

CONDENSER IMPULSE WELDING. Fr. Frungel and W. Thorwart. Translated from Z. Ver. deut. Ing. 96, 18-21(1954). 8p. (AERE-Trans-11/3/5/447)

642

APPEARANCE OF INTERNAL ABSORPTION OF INTERCRYSTALLINE GRAINS IN ALUMINUM ALLOYS BY THE METHOD OF MICROHARDNESS. V. I. Arkharab, I. P. Bepenova, and N. A. Kozina. Doklady Akad. Nauk S.S.S.R. 98, 207-9(1954) Sept. 11. (In Russian)

The appearance of absorption of intercrystalline grains in Al-Cu, Al-Ag, and Al-Zn alloys annealed for various times and at different temperatures was determined by measurement of the microhardness across the grain. (J.S.R.)

643

THE SLIP MODES OF TITANIUM AND THE EFFECT OF PURITY ON THEIR OCCURRENCE DURING TENSILE DEFORMATION OF SINGLE CRYSTALS. A. T. Churchman (Associated Electrical Industries, Ltd., Aldermaston, Berkshire, England). Proc. Roy. Soc. London 226A, 216-26 (1954) Nov. 9.

Single-crystal test specimens of van Arkel titanium were obtained by a modification of the strain anneal technique. The modes of slip have been identified as $(10\bar{1}0)$ $[11\bar{2}0]$, $(10\bar{1}1)$ $[11\bar{2}0]$, and (0001) $[11\bar{2}0]$. It has been shown that not only does the interstitial impurity affect the magnitude of the critical resolved shear stress but also the relative values for the three slip systems. $(10\bar{1}0)$ is the principal slip system and is favored by increasing purity. A possible mechanism for the role of oxygen and nitrogen in this effect is put forward, wherein it is shown that the interstitial sites occupied are such that interstitial elements render slip more difficult on two of the three slip planes in titanium. (auth)

644

CRACK PROPAGATION. Frederick Forscher (Westinghouse Electric Corp., Pittsburgh, Penna.). Welding J. (N. Y.) 33, 579s-84s(1954) Nov.

The literature on crack propagation is surveyed. Crack propagation due to mechanical action is reported and analyzed by means of a modified Griffith's crack mechanism.

A material property, so-called "fracture toughness," is of major importance; it equals the total energy (surface energy plus energy of plastic deformation) needed to form a pair of new unit surfaces; it also equals the driving force needed per unit length of crackfront. The relationship of the fracture toughness to the tensile strength and the work hardening coefficient is developed. A mathematical model is reported based on a mechanism which assumes Griffith cracks to grow while at the same time new ones are formed (ahead of the moving main-crack front) which, in turn, grow and eventually join with the earlier cracks to form the fracture surface. (auth)

645

HIGH-TEMPERATURE ALLOY FUSION BRAZING FOR TITANIUM AND TITANIUM ALLOYS. Roger A. Long and Robert R. Ruppender (Ferrotherm Co., Cleveland, Ohio). Welding J. (N. Y.) 33, 1087-90(1954) Nov.

A Ti−Ni−Cu−Co alloy has been developed for furnace brazing of Ti and Ti alloys. Compressive and tensile shear strengths in excess of 40,000 psi have been obtained. (M.P.G.)

646

THE MECHANISM OF METALLOGRAPHIC ETCHING. I. THE REACTION POTENTIALS OF A TWO-PHASE BRASS IN VARIOUS ETCHING REAGENTS. George L. Kehl and Max Metlay (Columbia Univ., New York). J. Electrochem. Soc. 101, 124-7(1954) Mar.

Potentials generated by reaction of portions of small, single grains of each of the two phases of alpha-beta brass with various etching solutions have been measured. The potential of beta phase is consistently 0.01 to 0.03 volt more anodic than that of the alpha phase in the same reagent. (auth)

647

CHEMICAL ENGINEERING ASPECTS OF TITANIUM METAL PRODUCTION. R. L. Powell (Titanium Metal Corp. of America, New York). Chem. Eng. Progr. 50, 578-81(1954) Nov.

The production of Ti is discussed from the ore to sponge Ti. Since the steps involved are chemical, the production on a commercial scale depends largely on the application of chemical engineering techniques and principles. (J.E.D.)

PHYSICS

648

Los Alamos Scientific Lab.
THE SPATIAL DISTRIBUTION OF ATOMS IN LIQUID He⁴. Louis Goldstein and James Reekie. [1954]. 54p. Contract [W-7405-eng-36]. (AECU-2964)

The x-ray scattering diagrams of liquid helium have been analyzed. The liquid He^4 atomic correlation and pair distribution functions have thus been obtained over a wide range of interatomic separations and at a number of liquid temperatures between 1.25 and 4.20°K. The limitations in the experimental scattering structure factors give rise, among others, to two types of limitations in the correlation functions. One of these concerns their behavior at small atomic separations; this limitation could be compensated for without difficulties. The second limitation appears to be connected with the lack of these functions of any manifest tendency toward their asymptotic behavior at large atomic

separations. The derived correlation or pair distribution functions should, nevertheless, be good approximations to their correct values at medium and intermediate separations extending to about fifteen angstroms, whereby the relevant range extends to 10 to 15 A. This could be verified using two types of integral checks on the correlation functions. In one of these, their space integrals, out to relevant distances, turned out to be quite close to their expected values determined only by the macroscopic properties of the liquid. In the second series of integral checks, they reproduced closely the original experimental structure factors. This verified the internal consistency of the calculations and indicated that the results should be correct at the relevant interatomic separations. At all the liquid temperatures investigated, in any sphere of given radius, around an origin atom, or in any spherical shell of given thickness, the computed number of atoms was always less than what one would compute neglecting the interatomic correlations. An application, of major physical significance, of the correlation or pair distribution functions obtained in this work was made by deriving the approximate mean potential energies per liquid He^4 atom at the various temperatures. The mean potential energy, as a function of the liquid temperature, has a cusp at the lambda point. Its temperature derivative, which is the configurational heat capacity, is thus discontinuous at the transition point with an inverted lambda type of discontinuity. The knowledge of this qualitative behavior of the configurational heat capacity was sufficient to prove, on quite general grounds, that the lambda transition of liquid He^4 is of kinetic energy origin, i. e., it is connected with the momentum space behavior of the liquid atoms. (auth)

649

Los Alamos Scientific Lab.
THIN GLASS WINDOWS. Arthur Hemmendinger and Arno P. Roensch. [1953]. 7p. Contract [W-7405-eng-76]. (AECU-2966)

The fabrication and properties of thin glass membranes are described. Foil thicknesses are a few tenths of a micron corresponding to energy losses for 1-Mev protons of 10 to 20 kev. (auth)

650

Institute of Engineering Research, Univ. of Calif., Berkeley
FLUID FLOW AND HEAT TRANSFER AT LOW PRESSURES AND TEMPERATURE. AN EXPERIMENTAL MOLECULAR BEAM INVESTIGATION OF THE SCATTERING OF MOLECULES FROM SURFACES. F. C. Hurlbut. Dec. 1, 1953. 109p. Contract N7-onr-295, Task 3. (HE-150-118; AD-30192)

A molecular beam apparatus was used to investigate the scattering of air and N_2 molecules from surfaces of polished low carbon steel, etched low carbon steel, polished aluminum, unpolished window glass, and polished window glass. A beam of molecules was directed against the surface at representative angles of incidence. Polar flux distributions of the scattered molecules were measured by a movable detector. An ionization gage beam detection system was devised to accomplish this measurement. Spatial polar plots of these measured flux distributions were found to approximate closely the form of the cosine scattering distribution for the cases of the steel and aluminum surfaces. Similar plots in the case of the glass surfaces were found to have well defined but small bulging deviations from the cosine

scattering shape on the side away from the incident beam. (auth)

651

Forest Products Lab.
EFFECT OF TEMPERATURES FROM 70° TO 600°F ON STRENGTH OF ADHESIVE-BONDED LAP SHEAR SPECIMENS OF CLAD 24S-T3 ALUMINUM ALLOY AND OF COTTON-AND GLASS-FABRIC PLASTIC LAMINATES. H. W. Eickner, W. Z. Olson, and R. F. Blomquist. [Jan. 26, 1951]. 27p. (NACA-TN-2717)

The performance of 14 commercial adhesives at temperatures from -70 to 600°F was evaluated in lap shear specimens of clad 24S-T3 aluminum alloy to itself and that of 7 commercial adhesives at -70 to 250°F in lap joints of cotton-fabric-phenolic laminate to itself, of glass-fabric-polyester laminate to itself, and in joints of each of these laminates to clad aluminum. One hot-setting tape adhesive was found to be consistently superior to all others in lap-joint specimens of aluminum tested at 450°F after 192 hr at 450°F. The best of the commercial adhesives evaluated at -70 to 250°F in lap shear specimens of plastic laminates bonded to themselves and to aluminum had only fair resistance to stressing immediately upon reaching 250°F. The adhesives generally performed adequately in the various joints at -70°F. (auth)

652

Research Lab. of Electronics, Mass. Inst. of Tech.
QUARTERLY PROGRESS REPORT [NO. 35 FOR PERIOD ENDING AUGUST 31, 1954]. J. B. Wiesner, G. G. Harvey, and H. J. Zimmermann. Oct. 15, 1954. 115p. Contract DA-36-039-sc-100. (NP-5427)

Measurements made in liquid He indicate that thermo-mechanical flow caused by heat input to a rotor is entirely responsible for the excessive damping previously observed. Equivalent circuit theory is worked out for a beam-type micro-wave amplifier tube. The existence of a nuclear magnetic octupole moment in Ga^{69} and Ga^{71} was investigated by remeasuring the 3 zero-field hfs intervals of the $^2P_{3/2}$ state. (For preceding period see NP-5287.) (K.S.)

653

Massachusetts Inst. of Tech.
STUDY OF METAL-CERAMIC INTERACTIONS AT ELEVATED TEMPERATURES. QUARTERLY PROGRESS REPORT FOR THE PERIOD ENDING OCTOBER 1, 1954. W. D. Kingery and F. H. Norton. 12p. Contract AT(30-1)-1192. (NYO-6296)

Measurements of surface tension and contact angles in the Fe-N system have been completed. Measurements have been made in the Fe-Se, Fe-Te, and Ni-In systems. A summary report on Fe alloys is in progress. Some additional measurements on sintering of NaF and CaF_2 are in progress. (For preceding period see NYO-6295.) (auth)

654

Carnegie Inst. of Tech.
THE USE OF LIQUID NITROGEN HEAT SHIELDS FOR STYROFOAM HYDROGEN TARGETS. F. Feiner and J. A. Kane. Nov. 9, 1954. 7p. Contract AT(30-1)-882. (NYO-7100)

Two designs are described of styrofoam hydrogen targets enclosed in jackets of liquid nitrogen. The chief advantages of using styrofoam for the containers are the ease with which they can be constructed, the fact that they are rugged and stable, and their density of 0.03 g/cm^3. (C.H.)

655

Oak Ridge National Lab.
THEORY OF THE PHOTOELECTRIC EFFECT.
1. FORMAL ASPECTS. M. E. Rose and L. C. Biedenharn.
Sept. 30, 1954. 35p. Contract W-7405-eng-26. (ORNL-
1779)

656

Clinton Engineer Works, Tenn. Eastman Corp.
HIGH-VOLTAGE PROBLEMS. J. D. Trimmer and Harry
Pearlman—H. Wesley Savage, ed. 1951. Decl. Sept. 14,
1954. 250p. Contract W-7401-eng-23. (TID-5211;
NNES-I-9)

This volume presents an account of the work done in
connection with the high-voltage systems used in the electro-
magnetic separation process. The two major problems
which confronted the successful operation of the units—
dielectric breakdown or "sparking" and high-voltage-in-
sulator breakdown— are discussed at length. The last
chapter briefly summarizes general conclusions drawn
from plant experience and experiments with insulators.
Recommendations are made regarding material, surface
contour, shields, negative junction, insulator orientation,
and mechanical and structural features. (G.S.)

657

Radiation Lab., Univ. of Calif., Berkeley
RECENT REFERENCES TO THERMODYNAMIC DATA.
Wendell M. Latimer. Aug. 1954. 27p. Contract W-7405-
eng-48. (UCRL-2680)

658

Naval Radiological Defense Lab.
PREPARATION OF SIMULANTS FOR CONTAMINANTS
PRODUCED BY NUCLEAR DETONATIONS IN HARBORS.
J. R. Lai, D. Macdonald, S. Baum, and P. E. Zigman.
Aug. 6, 1954. 38p. (USNRDL-TR-10)

Materials approximating some characteristics of the
contaminants produced by nuclear detonations in harbors
were prepared. These simulants, namely, Co^{60}, La^{140}, and
$Ce-Pr^{144}$, are composed of gamma-active nuclides and
commercially available clays. Each simulant was produced
by the sorption of a single ionic species on an individual
clay through processes developed by study of sorption rates.
Radioactivity retention by simulants in different media was
determined by evaluation of desorption rates. An equation
for evaluating radiation hazard when simulants are spread
over an area was developed and applied. (auth)

659

Pittsburgh-Des Moines Steel Co.
THE EFFECTS OF ATOMIC BOMB BLASTS ON ELEVATED
TANKS AND STANDPIPES. (RESEARCH REPORT NO.
26078). May 1954. 108p. Contract AT(36-1)-19. (WASH-
182)

A theoretical analysis was made of the effect of atomic
bomb blasts on elevated tanks and standpipes of the type
normally used in the atomic energy industry. Conclusions
presented were derived following a review of both classified
and unclassified literature, conferences with authorities in
the field, and a theoretical analysis of available data. (C.H.)

660

SURFACE TENSION OF SOLUTIONS OF ISOTOPES OF
HELIUM. B. N. Esel'son and N. G. Bereznyak. Doklady
Akad. Nauk S.S.S.R. 98, 569-71(1954) Oct. 1. (In Russian)
The surface tension of solutions of He isotopes (He^3 in He^4)

was determined as a function of the concentration of the
light isotope and the temperature. (J.S.R.)

661

CAN-OPENING FACILITIES. H. J. Bellarts (Hanford
Atomic Products Operation, Richland, Wash.). Nucleonics
12, No. 11, 80-1(1954) Nov.

Samples to be irradiated in the Hanford reactors are de-
posited in a small hole in a hollow Al slug and placed inside
an Al can that is welded shut. Shielded equipment is de-
scribed which is used for severing the cap from the sample
can, removing the cap to a safe place, reaching in and ex-
tracting the plug, then extracting the sample and depositing
it in a shipping container. (C.H.)

662

ISOTOPIC COMPOSITION OF ATMOSPHERIC OXYGEN
AND NITROGEN. Malcolm Dole, G. A. Lane, D. P. Rudd,
and D. A. Zaukelies (Northwestern Univ., Evanston, Ill.).
Geochim. et Cosmochim. Acta 6, 65-78(1954) Sept.

High-altitude air samples collected in glass bulbs during
balloon flights up to heights of 87,000 ft were found to con-
tain oxygen with a normal isotope ratio, deviations less than
+0.05%. Air samples collected in Aerobee rockets up to al-
titudes of 51.6 km contained nitrogen having a normal iso-
tope ratio, deviations less than ±0.15%. The oxygen of the
rocket samples contained a higher percentage of O^{18} than
normal, but when an estimated correction was applied for
the preferential loss of O^{16} by clean-up of oxygen by the
steel collecting tanks, the O^{18} percentage of the oxygen in
air at 51.6 km was normal to ±0.3%. Air collected at ground
level in a number of locations all over the world contained
oxygen having a normal isotope ratio to ±0.025%. Air
pumped out of ocean water at different depths in the Pacific
Ocean contained oxygen having a higher O^{18} percentage than
normal; the less the percentage of oxygen in the sample, the
greater was the O^{18} percentage. The oxygen isotope frac-
tionation factor for the process consuming dissolved oxygen
was 0.991. The nitrogen isotope ratio in dissolved ocean air
was normal. The oxygen isotope fractionation factor for the
clean-up or chemisorption of oxygen by steel was 1.026,
while the factor was 1.061 for the clean-up of oxygen by
copper. (auth)

663

A METHOD OF CONCENTRATING He^3-He^4 MIXTURES.
K. R. Atkins and D. R. Lovejoy (Univ. of Toronto, Ontario,
Canada). Can. J. Phys. 32, 702-7(1954) Nov. (cf. NSA
7-3824)

We have developed a method of increasing the concentra-
tion of He^3 in He^3-He^4 mixtures by "superfluid filtration,"
relying upon the fact that liquid He^4 flows rapidly through a
small leak while the He^3 in solution remains behind. In this
way an increase in concentration from 2% to 95% can be
achieved in a single operation. The rate of processing is
about 200 standard cc of the initial gaseous mixture per
hour. (auth)

664

ON NATURAL TECHNETIUM. Wilfrid Herr (Max-Planck-
Institut für Chemie, Mainz, Germany). Z. Naturforsch. 9a,
907-8(1954) Oct. (In German)

The Re content of Mo minerals from many different lo-
calities was analyzed, purified, and neutron irradiated. The
radiation from the Tc^{99m} produced in the reaction was
measured through Al and Pb absorbers. The ratios of the
intensities in 1000 and 5000 mg/cm^2 Pb suggests the possi-

bility of the presence of a small amount of Tc^{98} in the original minerals. (J.S.R.)

665

MEASUREMENT OF THE THERMOMECHANICAL EFFECTS IN HELIUM II AT APPROXIMATELY 1°K. V. P. Peshkov. Zhur. Eksptl'. i Teoret. Fiz. 27, 351-4(1954) Sept. (In Russian)

Measurements of the thermomechanical effects were made at 0.82°K. The value Q = ST and the entropy of He II, determined from thermomechanical effects and from data on the heat capacity, coincide completely. The value ρ_n/ρ, determined from the velocity of second sound, the heat capacity, and the entropy above 0.85°K, coincides with the values calculated by the Landau theory in the limits of experimental error. (tr-auth)

666

ORTHOBARIC DENSITIES OF He^3 1.3°K TO 3.2°K. Eugene C. Kerr (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 96, 551-4(1954) Nov. 1.

Saturated liquid and vapor densities of He^3 have been measured by a direct method in the temperature range of 1.3 to 3.2°K. The experimental data are represented by an empirical equation to probable errors of 0.1 percent for the liquid phase and of 1.3 percent for the vapor phase. (auth)

667

γ TRANSITION OF LIQUID HELIUM. Ryoichi Kikuchi (Univ. of Chicago, Ill.). Phys. Rev. 96, 563-8(1954) Nov. 1.

The partition function of liquid helium proposed by Feynman, $q = \Sigma g(L) \exp(- aTL)$, is calculated for a simple cubic lattice using an approximation corresponding to Bethe's method for the Ising model. It is shown that a second-order transition occurs at $aT_\lambda = \ln 4$, or $T_\lambda = 2.9 m/m'$ °K (m and m' representing the true and the effective masses of a helium atom). The nature of the approximation is discussed. (auth)

668

DIFFUSION OF CADMIUM, INDIUM, AND TIN IN SINGLE CRYSTALS OF SILVER. C. T. Tomizuka and L. Slifkin (Univ. of Illinois, Urbana). Phys. Rev. 96, 610-15(1954) Nov. 1.

The diffusion coefficient of cadmium, indium, and tin tracers in single crystals of pure silver has been measured as a function of temperature over the range 592 to 937°C. The activation energies and frequency factors were determined, yielding D = 0.44 exp(- 41,700/RT) for the cadmium tracer, D = 0.41 exp(- 40,630/RT) for indium, and D = 0.25 exp(- 39,300/RT) cm^2/sec for tin. These values are in marked disagreement with the older data. The results of the present work are discussed in terms of Lazarus' theory and Zener's theory. Both theories give fair agreement with the experimental data. (auth)

669

DIRECT QUANTITATIVE OBSERVATION OF THE THREE-PHOTON ANNIHILATION OF A POSITRON-NEGATRON PAIR. J. K. Basson (National Physical Lab., Council for Scientific and Industrial Research, Pretoria, Union of South Africa). Phys. Rev. 96, 691-6(1954) Nov. 1.

Three-photon annihilation of the positron with a negatron has been determined quantitatively as well as qualitatively by the simultaneous observation of the emitted photons with scintillation counters. The ratio of the reaction cross sections for two- and three-photon annihilation has been determined as $\sigma 2k/\sigma 3k = 402 \pm 50$. This is in agreement with

the theory of Ore and Powell but definitely differs from the theoretical values obtained by Lifshitz and by Ivanenko and Sokolov. (auth)

670

FISSION YIELD FINE STRUCTURE IN THE MASS REGION 99-106. Donald R. Wiles and Charles D. Coryell (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 96, 696-702 (1954) Nov. 1.

Fission yield measurements were carried out in the mass region 99 to 106 to investigate previously postulated fine structure related to nuclear closed shells. Radiochemical data were obtained in this mass region in the fission reactions $U^{235}(n,f)$, $U^{238}(\gamma,f)$, $U^{235}(d,f)$, and $U^{238}(d,f)$ for the yields of Mo^{99}, Mo^{101}, Mo^{102}, Ru^{103}, Ru^{105}, and Ru^{106}. Fine structure spikes were found in all reactions. It was found that the mass position of the spikes can be explained by the assumption that primary fission fragments with 82 neutrons or 50 protons and their complements have an enhanced yield as a result of selectivity in the fission process itself. Agreement was also found with two previously known reactions: $U^{233}(n,f)$ and Cm^{242} spontaneous fission. Fine structure is also predicted for several other fission reactions. (auth)

671

ENERGIES OF π^- MESONIC X-RAY K LINES. M. B. Stearns, M. Stearns, S. DeBenedetti, and L. Leipuner (Carnegie Inst. of Tech., Pittsburgh, Penna.). Phys. Rev. 96, 804-5(1954) Nov.1.

The energies of the 2p → 1s transitions of the π^- mesonic x rays were studied, using the method of critical absorption. A search was made for possible shifts caused by a specifically nuclear interaction of the meson. The experimental technique and method of calculation have been reported by the authors (Phys. Rev. 95, 1353(1954; 95, 625(A) (1954)), and the data are presented in the present paper. (L.T.W.)

672

THE SURFACE ENERGY OF SODIUM. Allen B. Scott (Univ. of Bristol, England). Phil. Mag. (7) 45, 1173-6(1954) Nov.

The surface energy of sodium, calculated by the use of the free-electron model, is modified by considering the increased electrostatic energy in the surface if the positive charge is assumed to be localized in the planes of the atomic nuclei instead of distributed uniformly. While the theoretical surface energy is increased significantly, the theory does not yet account for the energy observed experimentally. (auth)

ASTROPHYSICS

673

THE ACQUIREMENT OF COSMIC RAY ENERGIES BY ELECTROMAGNETIC INDUCTION IN GALAXIES. W. F. G. Swann (Bartol Research Foundation, Swarthmore, Penna.). J. Franklin Inst. 25, 383-93(1954) Nov.

A generalization and discussion of the principle of acceleration of charged particles to cosmic-ray energies through electromagnetic induction. Where the magnetic field grows with time with axial symmetry are presented. It is shown that: If a charged particle starts to acquire kinetic energy at t = 0, and if the magnetic field is zero at t = 0, then the particle acquires energy continually. If, at t = 0, the magnetic field is finite, a sufficient, but by no means necessary, condition for continual gain of energy is that $|E| \geq |H|$ for all positions and times. If, at t = 0, both magnetic field and

particle energy are finite, then, depending upon the sign of the initial angular velocity, the particle may gain or lose energy initially. However, if $|E| \geq |H|$, it will eventually start to gain energy and will continue to do so. Where the magnetic field and kinetic energy are both zero at t = 0, it appears that the kinetic energy T acquired by a proton which finds itself at the cylindrical radius r, where the average z component of magnetic field is equal to $\bar{H}_z$ within that radius, is such that $T > 150r\bar{H}_z$ electron volts. If $r \sim 25{,}000$ light years, and $\bar{H} \sim 7 \times 10^{-6}$ gauss, $T \sim 2.3 \times 10^{19}$ ev. It also appears that the particle in its motion spirals outwards, inwards, or remains on a circle, according as $\bar{H}_z > 2H_z$; $\bar{H}_z < 2H_z$; $\bar{H}_z = 2H_z$, respectively, where H_z is the average z component within the radius r at which the z component of the magnetic field has the value H_z. If, in its journey through places where $\bar{H}_z \neq 2H_z$, the particle reaches a place where $\bar{H}_z = 2H_z$, then it will asymptotically approach a stable circular orbit for that value of r. (auth)

COSMIC RADIATION

674

PROTONS AS THE PRIMARY COMPONENT OF COSMIC RADIATION. I. (Protonen Als Primare Komponente Der Kosmischen Strahlung). Karl-Heinz Höcker. Translated by D. A. Sinclair from Z. Physik 124, 351–91(1948). 45p. (TT-491)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 2-112.

675

ANISOTROPY OF HIGH-ENERGY COSMIC RAYS. Leverett Davis, Jr. (California Inst. of Tech., Pasadena). Phys. Rev. 96, 743–51(1954) Nov. 1.

Review of the evidence indicates that a magnetic field of the order of 10^{-5} gauss probably lies along a spiral arm of the galaxy. If so, any anisotropy observed in high-energy cosmic radiation must be associated with this field. Anisotropy might be due to: (a) acceleration by Fermi's mechanism, either by his longitudinal collisions or by betatron effects; (b) diffusion along field lines toward a region where the cosmic rays escape from the galaxy; (c) inhomogeneities in cosmic-ray density normal to the field lines. From symmetry considerations theoretical expressions are developed for the cosmic-ray flux as a function of direction and for the resulting sidereal time dependence of extensive showers as a function of latitude and the orientation of the detecting apparatus. If atmospheric effects can be corrected for, the main harmonics predicted are the first and second, the second being mainly due to anisotropy produced by acceleration. In the absence of detailed calculations based on a specific theory of the origin of cosmic rays and on the way the extensive showers are detected, the amplitude of the harmonics must be determined from experiment. Preliminary reports of measurements by Cranshaw and Galbraith and by Farley and Storey seem to indicate tentatively that the magnetic field is as described above and that cosmic rays are accelerated by Fermi's mechanism; the measurements of Daudin and Daudin require some other explanation. (auth)

676

BURSTS IN NaI(Tl) NEAR SEA LEVEL. S. Standil (Univ. of Manitoba, Winnipeg, Canada). Phys. Rev. 96, 777(1954) Nov. 1.

The spectrum of cosmic-ray events induced in a NaI(Tl) scintillation spectrometer has been observed near sea level.

The high-energy bursts so observed are interpreted as due mainly to nuclear interactions in the crystal with an energy distribution given by the power law $N(E)dE \propto E^{-3.6}dE$. The attenuation length for the star-producing component in concrete is found to be 200 ± 25 g/cm^2. (auth)

677

ENERGETIC DISINTEGRATION OF A HEAVY NUCLEAR FRAGMENT. W. F. Fry and M. S. Swami (Univ. of Wisconsin, Madison). Phys. Rev. 96, 809–10(1954) Nov. 1.

The energetic disintegration of a nuclear fragment found in a 1000-μ glass-backed plate which had been exposed to cosmic rays in a sky-hook balloon flight was analyzed. (L.T.W.)

678

THE LEAD ABSORPTION OF COSMIC RAYS. P. S. Gill (Aligarh Univ., India). Indian J. Phys. 28, 335–44(1954) July.

Detailed measurements of the absorption of cosmic rays in lead have been made of Gulmarg (8890 ft.), Srinagar (5000 ft.), Aligarh (600 ft.), and Swarthmore (296 ft.) with a view to determining the reported anomalies in the lead absorption curves at low latitudes. The data do not bring out any abnormality in curves other than at Gulmarg, where there is an indication of a dip at $p/\mu = .557$ Bev/c corresponding to 35-cm lead thickness. (auth)

679

THE RESIDUAL RANGE OF DELAYED PARTICLES IN EXTENSIVE AIR SHOWERS. V. C. Officer and P. J. Eccles (Univ. of Melbourne, Australia). Australian J. Phys. 7, 410–22(1954) Sept.

The arrival times of the penetrating particles of extensive air showers relative to that of the electrons have been studied by means of short reaction time Geiger counters. A 50-channel hodoscope has been used to identify the penetrating particles and measure their residual ranges where these lay between 15 and 30 cm of lead. From observations on 782 showers of median density, 70 particles/m^2 in which a penetrating component was detected, it was deduced that between 3 and 9 particles in 10^4 shower particles from showers of median density 28 particles/m^2, have delays $<5 \times 10^{-8}$ sec and are able to penetrate 15 cm of lead. It follows that 81 to 94 per cent of the delayed particles found by Jelley and Whitehouse (1953), without the use of absorbers, must be stopped by 15 cm of lead. This indicates a height of production below 0.8 km for at least half of these particles. Two of the penetrating delayed μ mesons were stopped in the lead, and their heights of production calculated to be $1.0^{+0.7}_{-0.4}$ km and $4.7^{+4.5}_{-2.2}$ km on the assumption that the delays were due to velocity differences. Thirty other μ mesons for which the individual time lags were not significant were also stopped in the lead and gave a mean delay indicating production below an altitude of 250 m. The remaining 208 μ mesons which did not stop could not be assigned a height of production. One delayed proton was found in the total of 29 delayed events observed, and nine events could have been oblique particles lagging on the electrons by virtue of path differences. (auth)

680

MOMENTUM DISTRIBUTION AND CHARGE RATIO OF μ-MESONS AT ZENITH ANGLES IN THE EAST-WEST PLANE. J. R. Moroney and J. K. Parry (Univ. of Melbourne, Australia). Australian J. Phys. 7, 423–38(1954) Sept.

The momentum distribution and charge ratio of the

penetrating component of the cosmic radiation at sea level have been determined over the momentum range 0.24 to 58 bev/c at a geomagnetic latitude of 47°S. The measurements were performed in the vertical direction and at zenith angles of 30° and 60° in the eastern and western azimuths. An attempt has been made to calculate the sea-level spectra at these zenith angles on the basis of a simplified continuous production process. A comparison with the measurements indicates that, although the calculations describe the general behavior, the quantitative agreement is unsatisfactory. The charge ratios measured at zenith angles in the western azimuth increase, and those in the eastern azimuth decrease, as the momentum decreases. This is explained as a secondary effect due to curvature of the meson trajectories in the magnetic field of the earth. Information has been obtained on the dependence of the exponent n on the momentum, where n is defined by the intensity-zenith angle relation, $I_\theta = I_0 \cos^n \theta$. From the value 3.3 at 0.3 bev/c, n approaches zero at high momentum. The radiation is approximately isotropic above 20 bev/c. (auth)

681

TIME VARIATIONS OF EXTENSIVE AIR SHOWERS AND THE ORIGIN OF COSMIC RAYS. T. E. Cranshaw and W. Galbraith (Atomic Energy Research Establishment, Harwell, Berks, England). Phil. Mag. (7) 45, 1109-18(1954) Nov.

An experiment is described in which sixteen Geiger counters each of area 200 cm^2 arranged on a square lattice of 54 m pitch were used in coincidence to count showers of energies about 10^{16}, 2×10^{16}, 5×10^{16}, and 10^{17} ev. From the shower rates, no evidence of a deviation from the power law spectrum, $R(>E) \propto E^{-1.7}$, was found. The results are analyzed in solar and sidereal time. In solar time no variations greater than 1% for the 10^{16} ev showers or 10% for the 10^{17} ev showers were found, and these amplitudes could easily arise as a result of statistical fluctuations. In sidereal time, no variation greater than 0.6% was observed at an energy of 10^{16} ev. At 2×10^{16} and 5×10^{16} ev, small variations were observed which had about 1% chance of being due to random fluctuations. The bearing of these results on theories of the origin of cosmic rays is discussed. (auth)

682

ON THE ACCELERATION OF COSMIC RAY PARTICLES. W. B. Thompson (Atomic Energy Research Establishment, Harwell, Berks, England). Phil. Mag. (7) 45, 1210-13(1954) Nov.

It is suggested that the acceleration of cosmic ray particles in interstellar space to energies of 10^{18} ev can be explained by assuming that small fluctuations in the magnetic field scatter the particles from their regular spiral paths, thus enabling them to gain energy from large fluctuations without being reflected. (M.P.G.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

683

THE CRYSTAL STRUCTURES OF Ni_5Ce, Ni_5La, Ni_5Ca, Cu_5La, Cu_5Ca, Zn_5La, Zn_5Ca, Ni_2Ce, MgCe, MgLa, and MgSr. (Die Kristallstruktur Von Ni_5Ce, Ni_5La, Ni_5Ca, Cu_5La, Cu_5Ca, Zn_5La, Zn_5Ca, Ni_2Ce, MgCe, MgLa, Und MgSr). Hans Nowotny. Translated by H. A. G. Natnan from Z. Metallkunde 34, 247-53(1942). (TT-492)

In the system nickel—cerium (lanthanum, calcium), copper—lanthanum (calcium), and zinc—calcium the compounds Ni_5Ce, Ni_2Ce, Ni_5La, Cu_5La, CuLa, Cu_5Ca, Zn_5Ca, and ZnCa were determined microscopically. For

some of the compounds reported in the literature the composition given is incorrect. The structures of isomorphous phases Ni_5Ce, Ni_5La, Ni_5Ca, Cu_5La, Cu_5Ca, Zn_5La, and Zn_5Ca were determined by x-ray photographs. The hexagonal cell contains 1 formula weight A_5B. The lattice constants and interatomic distances in these compounds were determined. The lattice consists of alternating layers of A atoms and a mixed layer. The relationship of this lattice to the Laves phases is discussed. The phase Ni_2Ce crystallizes in the C-15 type with $a_w = 7.178 \times 10^{-8}$ cm. It has a narrow range of homogeneity. It is found that the Laves phases show many anomalies. For instance, for Ni_2Ce the ratio of radii is 1.46. The compounds MgCe (La,Sr) are isomorphous with the CsCl type. The linkage conditions in the lattices mentioned are discussed on the basis of the distances. (auth)

ELECTRONS

684

THE EFFECT OF BACK-SCATTERING OF ELECTRONS ON MEASUREMENTS IN β-SPECTROSCOPY AND ABSOLUTE COUNTING. J. G. Balfour (Univ. of Glasgow, Scotland). J. Sci. Instr. 31, 395-8(1954) Nov.

The results of different observers on the back-scattering of electrons and β particles from various scattering materials show some measure of disagreement. Consequently, fresh measurements are made by means of a proportional counter using Te^{125}m as a source of three roughly monoenergetic groups of electrons within the energy range 0 to 105 kev. Relationships are found between the coefficient of back-scattering, the energy of the primary electrons, and the atomic number of the backing material. The results are in fairly good agreement with those obtained previously with a source of β particles placed outside the thin end window of a Geiger counter, but show marked disagreement with those obtained with the source placed inside the Geiger counter. The new measurements are related to the techniques of β spectroscopy and absolute counting, particularly where this involves proportional counters and 2π geometry. (auth)

GASES

685

MEMBRANE SEPARATION IN THE GASEOUS PHASE. Karl Kammermeyer and David William Brubaker (Iowa State Univ., Iowa City). Chem. Eng. Progr. 50, 560-4(1954) Nov.

The development of membrane separation in the gaseous phase is discussed. A comparison is made of the results obtained on two different types of porous membranes with those obtained on nonporous plastic membranes. The effects of temperature, pressure, and molecular weight of gas and the effect of either porous or plastic membrane are reported. (J.E.D.)

INSTRUMENTS

686

RELATION BETWEEN THE WIDTH OF AN X-RAY LINE AND THE RESOLVING POWER OF THE DOUBLE CRYSTAL SPECTROMETER. Gösta Brogren (Univ. of Uppsala, Sweden). Phys. Rev. 96, 589(1954) Nov. 1.

The widths of some K_{α_1} lines were measured in a double-crystal spectrometer in the (1, + 1) position. It was found

that the difference between the experimental width of the line and the width of the rocking curve had a constant value when perfect crystal gratings were used. (auth)

687

A LABORATORY APPARATUS FOR THE ACTIVATION OF LIQUIDS WITH Rn^{222}. E. Sanchez Serrano. Bol. radiactividad (Madrid) 25, 93-103(1952-53). (In Spanish)

This paper deals with the principles and operation of an installation for obtaining continuously activated fluids by radon in a slightly modified Bucquet activator, with a source of nearly 1 mg of radium. Few activities work well for biological experimentation with artificial waters of activity approaching that of natural waters of high radon contents. Some discussion is given about the optimum yield in relation to the periodicity of extractions, and several graphs are presented in connection with this type of instrument. (auth)

688

A SIMPLE DEVICE FOR ADJUSTMENT OF THE SKIN DISTANCE IN VIVO MEASUREMENTS OF RADIOACTIVE ISOTOPES. Lars Jonsson (Inst. of Radiophysics, Stockholm, Sweden). Acta Radiol. 42, 329-30(1954) Oct. (In English)

An optical system is described which proved satisfactory for determining the distance between source and detector following the administration of γ-emitting radioisotopes to humans. (C.H.)

689

APPLICATION OF THE TWO-BEAM INTERFERENCE MICROSCOPE TO THE STUDY OF SURFACES. W. L. Grube and S. R. Rouze (General Motors Corp., Detroit, Mich.). J. Opt. Soc. Amer. 44, 851-60(1954) Nov.

Interference microscopes that have recently become available have overcome many of the operational difficulties previously experienced. As a result, the two-beam interference microscope is finding increasing use in the laboratory in the study of surface topography. Present instruments are capable of examining surface detail in the range of 2 to 100 microinches peak-to-valley. A number of applications to the study of surfaces important in industry are presented. These include: (1) the measurement of thickness of electrodeposited coatings, (2) the study of the leveling properties of electrodeposits, (3) measurement of the erosion or shrinkage of paint films upon weathering, (4) investigation of hardness measurement indentations, (5) examination of industrial sheet-steel finishes, and (6) control of the geometry of accurate surface roughness standards. Replica techniques which make it possible to use the instrument to study curved and inaccessible surfaces are also discussed. (auth)

690

AN ELECTRON DIFFRACTION SPECIMEN CHAMBER WITH A SPECIMEN VACUUM LOCK. R. B. Kehoe, R. C. Newman, and D. W. Pashley (Imperial Coll., London, England). J. Sci. Instr. 31, 399-400(1954) Nov.

The specimen chamber of a new electron diffraction camera is described. A novel feature is the inclusion of a cover which allows the vacuum to be maintained immediately around the specimen, when air is admitted to the camera. This allows various operations to be carried out on the camera, without the specimen being exposed to the atmosphere. In addition, it is possible for specimens, while enclosed by the vacuum cover, to be transferred to the camera from external apparatus. Successful applications of this vacuum lock are given. (auth)

691

A DEMOUNTABLE VACUUM SEAL. C. B. Richards and

J. R. W. Smith (Electronic Tubes Ltd., High Wycombe, Bucks, England). J. Sci. Instr. 31, 431-2(1954) Nov.

MATHEMATICS

692

Los Alamos Scientific Lab.
THE MANIAC. [John B. Jackson and N. Metropolis.] Dec. 15, 1951. Revised July 16, 1954]. 309p. Contract W-7405-eng-36. (LA-1725)

MEASURING INSTRUMENTS AND TECHNIQUES

693

[Floyd Newman] Lab. of Nuclear Studies, Cornell Univ. THE USE OF QUENCHING CIRCUITS WITH SELF-QUENCHING COUNTERS. SCIENTIFIC REPORT NO. 2. Kenneth Greisen. Jan. 1954. 27p. Contract AF19(122)-439. (AD-28620)

The advantages associated with the use of a one-tube quenching circuit, to assist and hasten the termination of the discharge in self-quenching counters, are discussed. In general, the quenching circuit was found to have both economic advantages and benefits in terms of performance of the counters. Two types of quenching are distinguished, depending on the duration of the quenching pulse; the different virtues and failings of these two types of external quenching are outlined. An appendix gives supplementary considerations on the motion of the charge sheath in externally quenched and in unquenched counters. (auth)

694

Atomic Energy Research Establishment, Harwell, Berks (England)
OSCILLATOR APPARATUS FOR THE MEASUREMENT OF THERMAL NEUTRON ABSORPTION CROSS-SECTIONS IN B. E. P. O. V. G. Small and A. H. Spurway. May 20, 1954. 26p. (AERE-RP/R-1439)

This report describes an apparatus which has been constructed in BEPO for the measurement of thermal neutron absorption cross sections. It differs from the more orthodox type of pile oscillator, in that a local flux depression is measured, as opposed to an overall change in reactivity of the pile. (auth

695

Brookhaven National Lab.
A MICROSECOND SHUTTER FOR USE IN SEPARATING NEUTRONS OF VARIOUS SPEEDS. F. G. P. Seidl. July 1954. 62p. (BNL-278)

A high-resolution neutron time-of-flight spectrometer design is described in detail. Neutron beams in the order of 1 μsec duration are obtained by a rotating shutter, commonly called a neutron chopper. The beam is defined in the rotor by a series of narrow slits. A detector is placed some distance away from the rotor, and is activated by a light beam passing through the slit system with the neutrons. Neutrons of various speeds are then separated into narrow time channels according to their flight times between chopper and detector. (K.S.)

696

Hanford Works
DUAL CHANNEL PULSE ANALYSER AND COUNT-RATE METER FOR GAMMA SPECTROMETER MONITOR. R. S. Paul and M. R. Wood. June 17, 1954. 20p. Contract W-31-109-Eng-52. (HW-32166)

Descriptions are given of two prototype instruments

adapted for use with gamma-ray scintillation spectrometers in continuous-duty process monitoring applications where uninterrupted service is of primary importance. The first unit consists of a linear amplifier, two pulse height discriminators, and an anti-coincidence circuit. These provide a wide lower-energy Signal Channel output and a high-energy Reference Channel output. The second unit contains two count-rate meters and a simple difference detector. The output to a recorder is proportional to the difference between the Signal Channel counting rate and an adjustable fraction or multiple of the Reference Channel counting rate. (auth)

697

Joint Establishment for Nuclear Energy Research (Norway)
ABSOLUTE COUNTING OF α-PARTICLES AND NEUTRONS WITH A SCINTILLATION COUNTER.
Bertel Grimeland. Sept. 1954. 15p. (JENER-30)

Uranyl nitrate was dissolved in a mixture of water and alcohol, a small amount of the solution was mixed with ZnS(Ag) on an aluminium foil, the liquid evaporated and the sample placed on the photocathode of a photomultiplier tube, and absolute counting of the α particles carried out. The accuracy was 5% or better. The sample was also used as a neutron detector. Other neutron detectors examined were samples consisting of boric acid or lithium chloride, both mixed with zinc sulphide. The results obtained with the boron detectors were not too convincing. With the lithium detectors, neutron densities can be measured with an accuracy of 10% or better. Measurements were made to compare the absorption cross sections of boron and lithium and the fission cross section of U^{235} with the activation cross section of sodium. The results indicate that the activation cross section of sodium should be equal to its absorption cross section, that is 0.5 barns. (auth)

698

National Bureau of Standards
PHOTOGRAPHIC ROLL FILM FROM LOCAL DRUG-STORES FOR RADIATION SURVEYS IN THE CASE OF ATOMIC DISASTER. Joe R. Brooks and Margarete Ehrlich. Oct. 12, 1954. 22p. (NBS-3662)

The feasibility of using the black-and-white amateur roll films usually found on drugstore shelves in radiation surveys in the case of an atomic disaster is discussed. It is concluded that if the percentage of low-energy radiation in the particular radiation field is known at least approximately, suitable corrections could be made to the high-energy calibration curves, and the information gained would be an aid in evaluating the radiation exposure in the area in which the films were exposed. (C.H.)

699

Dublin Inst. for Advanced Studies, School of Cosmic Physics
MEASUREMENT OF IONIZATION IN PHOTOGRAPHIC EMULSIONS BY THE TECHNIQUE OF MEAN GAP LENGTH. C. O'Ceallaigh. [1954]. 24p. (NP-5372)

Advantages of ionization and velocity measurements in nuclear emulsions by recording the number of unresolved grains per unit track length are discussed. Special emphasis is placed on the technique for measuring the mean gap length, a fundamental quantity in establishing the relationship between "blob" and grain density. (K.S.)

700

Atomic Energy Project, Univ. of Calif., Los Angeles
APPLICABILITY OF CHEMICAL DOSIMETRY IN CIVIL

DEFENSE. George V. Taplin. Sept. 15, 1954. 26p. Contract AT-04-1-GEN-12. (UCLA-304)

The radiation characteristics of two types of chemical systems utilizing chlorinated hydrocarbons and aqueous pH indicator dyes are described. The report includes both laboratory and field test data which demonstrate the practical applicability of chemical systems in measuring prompt and/or residual bomb gamma radiation, as well as fast neutron radiation in the biologically interesting dosage range (50 to 600 r). (auth)

701

Atomic Energy Project, Univ. of Calif., Los Angeles
A LIQUID SCINTILLATION COUNTER FOR CARBON-14.
Jacob E. Dietrich and William R. Kennedy. Nov. 9, 1954. 18p. Contract AT-04-1-GEN-12. (UCLA-315)

A prototype liquid scintillation counter designed for counting C^{14} and possibly tritium is described. The instrument uses coincident circuitry and incorporates a circuit which rejects pulses originating from external radiation. A method of counting C^{14} in sodium carbonate and barium carbonate is described; from preliminary tests, counting efficiency is approximately 25 percent. (auth)

702

PORTABLE SCINTILLATION COUNTERS FOR GEOLOGIC USE. E. E. Wilson, V. C. Rhoden, W. W. Vaughn, and Henry Faul (U. S. Geological Survey, Washington, D. C.). U. S. Geol. Survey Cir. 353, 1954. 10p.

A small, light, portable scintillation counter, primarily intended for geologic field use, has been designed and is now commercially manufactured. The instrument embodies a very fast trigger amplifier and a compact relaxation-oscillator power supply. The circuit takes full advantage of the high counting rate that can be obtained from a sodium iodite crystal. Another, still smaller and lighter, scintillation counter of the total intensity type is now being tested. (auth)

703

AN OPTICAL SHUTTER FOR SCINTILLATION METERS.
J. F. B. Dealler (Radium Inst., Bradford, Yorks, England). Brit. J. Radiol. 27, 646(1954) Nov.

The simple optical shutter described is constructed of two pieces of polarising material and was designed for use with a Perspex guide to eliminate unwanted signals in scintillation dose-rate meters. (C.H.)

704

RADIATION UNITS AND RADIATION INSTRUMENTS.
H. M. Parker (General Electric Company, Richland, Wash.). Radiology 63, 629-36(1954) Nov.

A brief review of early dosimetry methods is given, leading to the establishment of the roentgen. The absorbed dose concept arising from the Bragg-Gray Principle is coupled with the increased interest in radiobiology to lead to direct tissue dose determination in terms of energy absorption as the method of choice. Instrumentation methods are then classified as basic primary methods if they yield absorbed dose, basic secondary methods if they yield dose in roentgens, and nonbasic secondary methods if they require calibration against a primary method. Some notes on appropriate methods and units for particulate radiations and for mixed exposures are given. Special cases in which energy absorption can be derived from first principles in isotope irradiation are mentioned. The alternative approach by the physical method of conversion of intensity to dose rate is indicated. (auth)

705

SURFACE DOSE. Elizabeth F. Focht (Memorial Center for Cancer and Allied Diseases, New York). Radiology 63, 637-45(1954) Nov.

The contributions of the surface dose to the measurement of tissue doses of ionizing radiations, the theory of dose determinations, methods and results of some measurements, and practical applications of the measurements are reviewed briefly. (C.H.)

706

INTENSITY AND ABSORBED DOSE RATE. John S. Laughlin (Sloan-Kettering Inst. and Memorial Hospital, New York). Radiology 63, 646-55(1954) Nov.

Concepts of intensity and absorbed tissue dose rate of ionizing radiations, units of measurement, the relationship between conventional ionization chamber measurements and intensity and absorbed dose rate for both x rays and electron beams, the importance of intensity measurements, and experimental approaches to the measurement of both intensity and absorbed dose rate for both x ray and electron beams are reviewed briefly. (C.H.)

707

SCINTILLATION RESPONSE OF PHOSPHORS AT LOW PARTICLE ENERGIES. G. T. Wright (Rhodes Univ., Grahamstown, South Africa). Phys. Rev. 96, 569-70(1954) Nov. 1

The results of a detailed statistical analysis of the scintillation counter are used to correct previously published data for the response to low-energy photoelectrons of NaI(Tl) and anthracene. The nature of the true response curves is discussed. (auth)

708

IONIZATION ENERGY LOSS OF MESONS IN A SODIUM IODIDE SCINTILLATION CRYSTAL. Theodore Bowen (Univ. of Chicago, Ill.). Phys. Rev. 96, 754-64(1954) Nov. 1.

The response of a thallium-activated sodium iodide crystal to high-energy charged particles passing through the scintillator has been investigated. Pions and muons produced by the Chicago 450-Mev cyclotron have been used to cover energies ranging from 61 Mev (pions) to 245 Mev (muons). Sea-level cosmic-ray muons have been used to cover energies from 200 Mev to greater than 2 Bev. At each energy, the most probable energy loss is determined from the pulse-height distribution, making use of Po-Be 4.44 Mev γ rays for an energy calibration. The distributions from cyclotron data are found from the density variations on photographs of the superposition of many pulses appearing on an oscilloscope. Because the cosmic-ray counting rate is low, each pulse is individually photographed and measured. The results for energies below the occurrence of the minimum in ionization indicate good agreement with the probable energy loss as given by the Bethe-Bloch formula. Beyond the minimum the probable loss is in fair agreement with Sternheimer's calculations for sodium iodide, rising slightly more rapidly than predicted to the Fermi plateau. (auth)

709

NEW METHOD OF THE PHOTOMEASUREMENT OF PARTICLE TRACKS IN PHOTOEMULSIONS. Yu. P. Mironenko and Zh. S. Takibaev. Zhur. Eksptl'. i Teoret. Fiz. 27, 390-2(1954) Sept. (In Russian)

The range of particle tracks in nuclear emulsions can be calculated immediately by means of high-sensitivity photomultipliers. The circuit used and test results are given. (J.S.R.)

710

A PORTABLE INTEGRATING CIRCUIT FOR LOW RADIOACTIVITY COUNTS. A. H. Ward (Univ. Coll. of the Gold Coast, West Africa). J. Sci. Instr. 31, 429-30(1954) Nov.

A portable linear integrating circuit has been designed which uses a low-inertia electric motor, battery driven by a normally biased multivibrator pair of pentodes, and coupled to a mechanical register. The circuit produces a motor speed proportional to the counting rate. Losses due to fast counting become important above 300 counts/min, as the paralysis time of the circuit can be adjusted only to 10 msec. Anode current drain is 5 ma at 90 v, and filament current is 50 ma at 3v. (K.S.)

711

A PULSE-INTERVAL METER FOR MEASURING PULSE REPETITION FREQUENCY. PART I. A. M. Andrew and T. D. M. Roberts (Univ. of Glasgow, Scotland). Electronic Eng. 26, 469-74(1954) Nov.

The type of counting-rate meter commonly used with Geiger counters is not suitable for indicating pulse repetition frequency when the P.R.F. is changing rapidly and the indication is required to follow the variations accurately. Its limitations are serious in neurophysiological applications. An instrument is described which measures each pulse interval and provides an output voltage which is a linear function of the reciprocal of interval duration. The output voltage of the instrument at any instant is determined either by the duration of the preceding pulse interval or by the duration which the current interval has already attained, whichever is the longer. In this way the instrument gives a continuous indication of P.R.F. and responds to a change as rapidly as is physically possible. (auth)

712

ON A NEW METHOD OF STUDYING RADIOACTIVE PHENOMENA: "KINETIC NUCLEOGRAPHY." Marcel Laporte (Institut du Radium, Paris). J. phys. radium 15, 705-13 (1954) Nov. (In French)

A new method for the study of radioactive phenomena, called "kinetic nucleography," is discussed. As elements of study, tracks on nuclear plates from corpuscular radiation are used. The method differs from the classical method in the fact that the source, instead of being incorporated in the gelatin, is placed externally on the plate and moved uniformly at a regulated speed. During its movement the source must be kept at as constant and small a distance as possible from the plate. It is shown how this method allows the absolute determination of the activity of an α emitter in a very wide range of activities. (tr-auth)

713

MEASUREMENT OF THE ACTIVITY OF α EMITTERS BY KINETIC NUCLEOGRAPHY. O. Roehrich-Goussu (Institut du Radium, Paris). J. phys. radium 15, 714-15(1954) Nov. (In French)

The results of the activity determinations of Po sources by kinetic nucleography are given. For sources from a tenth to several hundredths of a μc, the results agree within 2% with those obtained by classical methods of measurement. This proves the utility of kinetic nucleography in those ranges of activity (from μc to mc) when the usual techniques give low or nonprecise results. (tr-auth)

714

A REALIZATION OF THE KINETIC NUCLEOGRAPHY OF PROFESSOR LAPORTE. Marcel Frilley (Laboratoire

Curie, Paris). J. phys. radium 15, 715-17(1954) Nov. (In French)

An apparatus designed to record in nuclear emulsions the trajectories of particles by a mobile radioactive source so that the source intensity or the period of a short-lived element can be measured is described. (tr-auth)

715

MEASUREMENT OF THE ENERGY OF ELECTRONS RECORDED IN NUCLEAR EMULSIONS. M. Maitrot and M. G. Marguin (Institut de Physique atomique, Lyon, France). J. phys. radium 15, 718-25(1954) Nov. (In French)

The recording of the electrons from Bi^{210} was successfully attempted with Ilford G5 plates. The average scattering angle for different energy values of the incident electron, from 170 to 780 kev, was measured and compared with theory. (tr-auth)

716

AN 0.5- TO 6-MEV NEUTRON DETECTOR WITH UNIFORM SENSITIVITY AS A FUNCTION OF ENERGY. Philippe Eberhard (Collège de France, Paris). J. phys. radium 15, 765-6(1954) Nov. (In French)

The principles, characteristics, and method of measurement are described for a 0.5- to 6-Mev proportional detector. The effective cross section of the detector is 1.75 $cm^2 \pm 10\%$, and the counting is not disturbed by a γ flux less than $10^7 \gamma/cm^2/sec$. (tr-auth)

717

ON THE DISTRIBUTION OF DEAD TIME IN GEIGER-MÜLLER COUNTERS. E. Picard and A. Rogozinski (C. E. N., Saclay, France). J. phys. radium 15, 767-75(1954) Nov. (In French)

By oscillographic methods, the total time which elapses between the passage of a particle in a region determined from the counter studied and the response of the counter amplifier was measured. This dead time is composed of the latent time, and of the dead time T_q, which results from the time of the completed impulse increase and value of which depends on the sensitivity threshold of the amplifier. The selection of particles generating the discharge in the counter studied was made with a telescope of two counters in coincidence whose opening is limited by a group of four counters is anticoincidence with the first. The counter is placed in such a fashion that the middle plane of the telescope crosses it to a variable distance d of its axial wire. The measurements were made for different values of the distance and of the overvoltage V_s applied to the counter. The results show that the statistical distribution of dead time has more spread the larger d and the smaller V_s. The average values of the dead times observed varied from 7×10^{-8} sec for d = 0 and V_s = 200 v to 90×10^{-8} sec for d = 1.9 cm and V_s = 50 v. The mobility of a free electron in the gaseous mixture filling the counter at a pressure of 10 cm of Hg was equal to $(2.1 \pm 0.2) \times 10^4 cm^2/sec$-v. (tr-auth)

718

β SPECTROMETER ALLOWING THE STUDY OF $\beta - \gamma$ RAYS IN COINCIDENCE. Jean Moreau (C. E. N., Saclay, France). J. phys. radium 15, 776-7(1954) Nov. (In French)

The design of a β spectrometer allowing the study of $\beta - \gamma$ rays in coincidence is described. The source and detector are placed in a region with a very weak field, and a metallic mass is placed between the crystal scintillators. (J.S.R.)

719

STUDY OF THE IONIC MULTIPLICATION COEFFICIENT IN COUNTERS FILLED WITH CO_2. R. Fourage and L. Miramond (École supérieure de Physique et Chimie, Paris). J. phys. radium 15, 780-1(1954) Nov. (In French)

The ionic multiplication coefficients were obtained for G-M tubes filled with pure CO_2 at 1, 5.2, 11.6, 29, 51, and 68.7 cm Hg and with a CO_2— alcohol mixture. The CO_2 was kept at 11.6 cm Hg, but the alcohol pressures were 1, 4, 11, and 38 cm of Hg. (J.S.R.)

720

METHOD FOR THE RAPID DEVELOPMENT OF THICK NUCLEAR EMULSIONS BY "AMIDOL ACID." A. Bernet and M. R. Chastel (Collège de France, Paris). J. phys. radium 15, 781-2(1954) Nov. (In French)

Thick nuclear emulsions can be developed rapidly by the use of amidol in an acid medium. As amidol requires a critical pH before it reduces the halide salts and the emulsion can contribute to the basicity of the solution, a rigid control of the acid content will result in a homogeneous development of the emulsion. (J.S.R.)

MESONS

721 .

Palmer Physical Lab., Princeton Univ. NUCLEAR ABSORPTION OF μ MESONS IN MEDIUM AND HEAVY ELEMENTS.(thesis). Albert J. Meyer. Oct. 10, 1954. 126p. Contract N60NR-270-II, Technical Report No. 16. (NP-5418)

An apparatus for the measurement of the absorption probabilities of cosmic-ray μ mesons in materials available in 10 or 20 kg amounts has been developed. As in earlier work, the mean life of delayed non-ionizing radiation from a target in which mesons disappear is measured. With improved liquid scintillators and a more efficient geometrical arrangement than has previously been used, a typical 14 kg target gives a meson absorption rate of about $7 hr^{-1}$. With such a target, the meson lifetime can be measured to an accuracy of 10% in a half week. Two trays of hodoscoped Geiger counters were put in the telescope that accepted incident mesons, and only events in which one and only one Geiger counter in each tray was triggered were classified as meson events. In one of the two dispositions, half-inch lead plates were arranged above the hodoscoped counters as an electron shower detector; in the other, the space between the counter trays was filled solidly with a total of about 200 g cm^{-2} of lead. The following mean lives, in μsec, were obtained: Cu 172.0 $\pm$ 7.6; Mo 96.2 $\pm$ 5.9; Ag 84.4 $\pm$ 3.5; Cd 100.9 $\pm$ 6.1; Sn 85.7 $\pm$ 4.9; Sb 82.6 $\pm$ 7.1; Hg 72.3 $\pm$ 4.3; Pb 74.5 $\pm$ 3.3. The only previous heavy-element experimental results, the results of earlier Princeton work, are in disagreement with the present mean lives; a reanalysis of the earlier data shows that the decay curves were contaminated with unrecognized spurious counts. The uncertainties in theoretical values for the absorption probabilities are considerably greater than the statistical errors in the experimental values reported here, but the latter are consistent with the hypothesis that the μ meson absorption coupling constant is equal to that for β-decay. (auth)

722

SCATTERING OF π MESONS BY NUCLEONS IN THE ATTENUATION THEORY. G. F. Zharkov. Zhur. Eksptl'. i

Teoret. Fiz. 27, 296-306(1954) Sept. (In Russian)

It is shown that the scattering of pseudoscalar π mesons by nucleons agree with the covariant attenuation theory with the calculation of arbitary mixtures of pseudoscalar and pseudovectoral bonds. The attenuation theory, as well as the perturbation theory, does not agree with experimental data with the exception of the narrow interval of energy at approximately 30 to 40 Mev, where, as yet, there is insufficient experimental data. (tr-auth)

723

DOUBLE PION PRODUCTION AND THE NATURE OF PSEUDOSCALAR COUPLING. P. Bocchieri and G. Feldman (Univ. of Birmingham, England). Phil. Mag. (7) 45, 1145-53(1954) Nov.

A perturbation calculation for single and double pion production is carried out for pseudoscalar, symmetric meson theory at energies in the Birmingham range (about 1000 Mev). It is found that the γ_5 nature of the coupling does not favor double over single production and that, in fact, a large coupling constant would be required to explain a large double to single ratio. (auth)

724

FURTHER EVIDENCE FOR THE β-DECAY OF K-MESONS. C. Dahanayake, P. E. Francois, Y. Fujimoto, P. Iredale, C. J. Waddington, and M. Yasin (Univ. of Bristol, England). Phil. Mag. (7) 45, 1219-21(1954) Nov.

The apparent decay of a K meson into an electron with an energy of 50 Mev is reported. (M.P.G.)

725

AN ABNORMAL τ-MESON DECAY. R. R. Daniel and Yash Pal (Tata Inst. of Fundamental Research, Bombay, India). Proc. Indian Acad. Sci. A40, 114-18(1954) Sept.

An unusual example of a τ^+-meson decay in nuclear emulsions is described. From the measurements made on the momenta and direction of the three π mesons emitted, the event is interpreted as a decay of a τ-meson according to the scheme: $\tau^+ \rightarrow \pi^+ + \pi^+ + \pi^- + \gamma + Q$. In a systematic investigation of the origin of slow π mesons, an interesting example of a τ meson brought to rest and decaying in an emulsion block detector flown for about three hours above an altitude of 70,000 ft. was observed. (auth)

MICROWAVES

726

Western Reserve Univ.

INVESTIGATION OF ALTERNATING GRADIENT PARTICLE FOCUSING ACTION OF A TM_{01} GUIDED WAVE. Richard A. Beth, Brookhaven National Lab. and Wilkinson W. Meeks, Western Reserve Univ. June 29, 1954. 14p. Subcontract S-254. (BNL-308)

A TM_{01} wave in a cylindrical wave guide can exert an alternating gradient focusing action on a beam of charged particles within the guide. The relativistic equations of motion of the particles admit three exact integrals by means of which a single nonlinear second-order total differential equation governing the motion is derived, without approximations. The linear approximation is a Mathieu equation whose solution indicates the magnitude of the focusing forces involved and shows that these are stronger when the wave is propagated in a direction opposite to that in which the particles move. It is shown that a wave providing fields of the order of several thousand volts/cm would be required to counteract the space charge defocusing effects in a typical electron beam. (auth)

MOLECULAR PROPERTIES

727

THERMAL EXPANSION OF LITHIUM, 77° TO 300°K. W. B. Pearson (National Research Council, Ottawa, Canada). Can. J. Phys. 32, 708-13(1954) Nov.

Measurements of the lattice parameters of lithium at temperatures below 300°K have been made and the results are compared with previous work and considered in terms of the Grüneisen relationship. Methods of low temperature X-ray photography are also discussed. (auth)

728

ELECTRICAL CONDUCTIVITY OF SINGLE CRYSTALS OF GRAPHITE ALONG THE BASAL PLANE AND A NEW AND SIMPLE METHOD OF MEASURING ELECTRICAL CONDUCTIVITIES. Ajit Kumar Dutta and Amalendu Chowdhury (Indian Association for the Cultivation of Science, Calcutta). Indian J. Phys. 28, 312-18(1954) July. (cf. NSA 7-3385)

The electrical conductivity of single crystals of graphite for currents along the basal plane, shows a gradual increase with decrease of thickness. This is due to the fact that owing to the large electrical anisotropy, the current distribution is not uniform throughout the entire thickness and in consequence all methods involving the question of actual electrical contacts will not give the proper value of the conductivity. The present paper gives the details of a very simple method of measuring the electrical conductivity of specimens in the form of thin plates, in which the question of electrical contacts have altogether been eliminated. The method depends upon the observation of the damping produced due to eddy currents generated in the specimen when oscillating in a uniform magnetic field. Finally, it has been shown that the conductivities obtained from crystals of different thicknesses remain practically the same. (auth)

729

DETERMINATION OF ATOMIC MASSES BY MICROWAVE SPECTROSCOPY. S. Geschwind, G. R. Gunther-Mohr, and C. H. Townes (Columbia Univ., New York City). Revs. Mod. Phys. 26, 444-55(1954) Oct.

The development of microwave spectroscopic techniques for the determination of atomic mass by observation of the isotopic shift in pure rotational molecular spectra is reviewed. A formulation of the theory is followed by a brief description of experimental techniques and a discussion of recent mass measurements. (K.S.)

730

MASS SPECTROSCOPIC ATOMIC MASS DIFFERENCES. Henry E. Duckworth, Benjamin G. Hogg, and Edwin M. Pennington (McMaster Univ., Hamilton, Ontario, Canada). Revs. Mod. Phys. 26, 463-72(1954) Oct.

These tables are concerned with atomic mass differences which have been obtained mass spectroscopically by the doublet method. They are a part of a program designed to present in convenient form data pertaining to atomic masses. (auth)

NUCLEAR PHYSICS

731

Columbia Radiation Lab., Columbia Univ.

QUARTERLY [PROGRESS] REPORT. Oct. 30, 1954. 48p. Contract DA-36-039-SC-42519, Report No. 8. (NP-5421; CU-8-54-SC-42519-Phys.)

Further improvements have been made in the tunable magnetron at a wavelength of about 1 cm. These tubes

now give a tuning range approaching 0.2 cm with a good power output and efficiency over the range. Ceramic output windows have been successfully used in tubes at 6 mm and an average power of 50 watts has been measured. A series of tubes has been designed and constructed to operate under pseudo-cw conditions at low magnetic field at about 1 cm. The results are promising and suggest the possibility of constructing useful cw tubes at this wave length. The design and construction of an additional molecular beam oscillator is well advanced. A new apparatus for the measurement of the Lamb Shift in ionized helium has been completed and should yield a definitive measure of the Lamb shift in the near future. The measurement of the hyperfine structure of hydrogen in the metastable state is being actively pursued and it is anticipated that a definitive measurement of this quantity will soon be available. The spectra of the various thallium halides have been measured on the high temperature microwave spectrometer. (For preceding period see NP-5301.) (auth)

732

NEUTRON-PROTON MASS DIFFERENCE. W. G. Holladay and R. G. Sachs (Univ. of Wisconsin, Madison). Phys. Rev. 96, 810-11(1954) Nov. 1.

It has recently been suggested (R. G. Sachs, Phys. Rev. 87, 1100(1952)) that the nucleon may be treated as a structured system having varying numbers of pions in bound states centered on a core particle of spin and isotopic spin $\frac{1}{2}$. This note points out that this model accounts for the sign and order of magnitude of the neutron-proton mass difference on the basis of electromagnetic interactions alone. (L.T.W.)

733

ELECTRON SCREENING AND THERMONUCLEAR REACTIONS. E. E. Salpeter (Australian National Univ., Canberra). Australian J. Phys. 7, 373-88(1954) Sept.

In the interior of stars most atoms are ionized, but the electrostatic potential of a bare nucleus induces a spherically symmetric polarization of the surrounding electrons and nuclei. The effect of this screening charge cloud on the rate of thermonuclear reactions is investigated for the case of complete ionization of all atoms. The charge distribution and potential of the screening cloud is calculated for two limiting cases where the electrostatic interaction energy between neighboring nuclei is small or large compared with the thermal energy (weak or strong screening). The charge cloud is also investigated for intermediate strength of screening, for nuclear species which are rare and have a large charge. Under most stellar conditions the impact parameter for a thermonuclear collision is much smaller than the radius of a screening cloud. For such cases, a simple formula is given relating the increase in the reaction rate to the potential of the screening cloud. Numerical values are presented for a few typical reactions. For conditions typical for the interior of ordinary main sequence stars the increase in the reaction rate is fairly small, usually less than a factor of two. (auth)

NUCLEAR PROPERTIES

734

Michigan Univ.
DECAY SCHEME AND CHARACTERIZATION STUDY OF RADIOACTIVE PRODUCTS OF DEUTERON REACTIONS.

Wayne A. Cassatt, Jr. Sept. 24, 1954. 163p. Contract AT(11-1)-70. (AECU-2958)

The γ-ray spectrometer, β-ray spectrometer and coincidence counter assembled and put into operation for this investigation are described. New or more precise nuclear data are given for the radioactive isotopes V^{47}, Y^{85}, Y^{92}, Ag^{104} and In^{107}, all of which were obtained by chemically separating these elements from targets bombarded with 7.8-Mev deuterons. Previously unreported gamma rays were observed and their energy measured in the case of V^{47}, Y^{92}, Ag^{104} and In^{107}. Less definite evidence for other gamma rays emitted by Y^{85} and V^{47} was obtained. A direct measurement of the half life of Y^{85} gave what is felt to be a more accurate value than is found among the widely varying values reported in the literature. Coincidence measurements are reported for the first time for Y^{85}, Y^{92}, Ag^{104} and In^{107}. Assignment of the observed radiation to In^{107} and Ag^{104} was aided by the use of cadmium oxide targets enriched in Cd^{106}. Upon the basis of the data obtained and certain other information found in the literature, decay schemes are suggested for Y^{92}, Ag^{104} and In^{107}. The information obtained on the gamma radiation emitted by V^{47} and Y^{85} seems to be in disagreement with data recently reported by other workers. (auth)

735

Radiation Lab., Univ. of Calif., Berkeley
RADIOCHEMICAL AND SPECTROMETER STUDIES OF SOME NEW NUCLEAR ISOMERS PREPARED BY CYCLOTRON BOMBARDMENT (thesis). Hirdaya Behart Mathur. Oct. 5, 1954. 108p. Contract W-7405-eng-48. (UCRL-2744)

The preparation and identification of some new nuclear isomers of various nuclear types are discussed in relation to the predictions of the independent particle shell model of the nucleus. A detailed study of the decay schemes of Cs^{127} and Cs^{125} revealed branching decay to isomeric levels in the odd-mass isotopes Xe^{127} and Xe^{125}. E3 transitions of 75 and 55 seconds, respectively, were observed. By bombardment of zirconium, niobium, yttrium and silver targets in the 184-inch cyclotron it was possible to produce and study the isomeric pair Nb^{89m} and Nb^{89}. In addition to the study of odd-mass number isotopes, information was obtained on previously unreported even-mass number isomers. A detailed study of the radiations of Mo^{90} revealed the presence of the new odd-odd isomers, 24-second Nb^{90m} and 10-millisecond Nb^{90m_2}, in addition to the ground state, 14.6-hour Nb^{90}. Isomeric levels in even-even nuclei are rare but in the study of 14.6-hour Nb^{90} a delayed state of 2.2-Mev decay energy has been established in the even-even nucleus Zr^{90}. New nuclear data unrelated to isomerism is included on some isotopes of cesium, xenon and iodine. (auth)

736

Radiation Lab., Univ. of Calif., Berkeley
A FIVE-MILLISECOND GAMMA EMITTER FROM PROTONS ON TANTALUM (Part B of thesis). Sheldon Dorman Softky. Oct. 8, 1954. 22p. Contract W-7405-eng-48. (UCRL-2754)

A search for gamma emitters in the millisecond range of half life was conducted, using the 32-Mev Berkeley proton linear accelerator. Foil targets of eighteen common elements were bombarded, and the activity made in them was followed between beam pulses with a gated scintillation counter. The only activity found of measurable yield was

from Ta, and it exhibited a half life of 5.5 ± 0.3 milli-
seconds. Using a gated nine-channel pulse-height analyzer
with the NaI(Tl) crystal counter, the excitation curve of
this activity was measured, and its gamma spectrum de-
duced. Gammas of 0.35 and 0.22 Mev are indicated by
the pulse spectrum, and no β's are present commensurate
with this half life. Comparison of the excitation curve for
this activity with those of Ta^{180} (8 hour) and W^{179} (30 m)
leads to the tentative assignment of this decay to W^{180m}.
As far as can be determined, this is the first known isomer
with half life in the millisecond range. (auth)

737

NEUTRON BINDING ENERGIES FROM (d, p) Q VALUES.
N. S. Wall (Massachusetts Inst. of Tech., Cambridge).
Phys. Rev. 96, 664-9(1954) Nov. 1.

The Q values for the (d, p) reactions on some 27 targets
whose neutron numbers are around the closed shells of 50
and 82 neutrons were determined. The general interpreta-
tion of these results and the specific application of these re-
sults to a variety of problems is discussed. In general, the
results show a break of approximately 2 Mev at each of the
shell edges. The technique used was that of a NaI scintilla-
tion spectrometer and is described in some detail. Compar-
ison is also made with previous measurements by different
techniques. (auth)

738

FISSION AND TOTAL REACTION CROSS SECTIONS FOR
22-MEV PROTONS ON Th^{232}, U^{235}, AND U^{238}. G. H. Mc-
Cormick (Denver Univ., Colo.) and B. L. Cohen (Oak Ridge
National Lab., Tenn.). Phys. Rev. 96, 722-4(1954) Nov. 1.

Absolute excitation functions for (p,f) reactions in Th^{232},
U^{235}, and U^{238} were measured by radiochemical techniques;
at 21.5 Mev, the cross sections are 0.83, 1.31, and 1.28
barns, respectively (± 15 percent in each case). Cross sec-
tions for (p,xn) reactions in U^{238} were found to be quite
small. The total reaction cross sections correspond to a
nuclear radius of $(1.55 \pm 0.1)A^{1/3} \times 10^{-13}$ cm. Some advan-
tages of determining the nuclear radius by total reaction
cross sections are pointed out, and the discrepancy between
electromagnetic and nuclear determinations of the nuclear
radius is discussed. (auth)

739

ENERGY LEVELS OF Al^{27}. C. P. Browne, S. F. Zimmer-
man, and W. W. Buechner (Massachusetts Inst. of Tech.,
Cambridge). Phys. Rev. 96. 725-9(1954) Nov. 1.

Proton groups inelastically scattered from Al^{27} were ob-
served with a high-resolution magnetic analyzer. Bombard-
ing energies between 5.6 and 8.4 Mev were provided by an
electrostatic generator. Twenty-two levels have been ob-
served up to 6-Mev excitation. Discrepancies with previous
work, both as to number and position of levels, appear. A
level at 1.777 Mev in Si^{28} was also measured. (auth)

740

ENERGY LEVEL DISPLACEMENTS IN PI-MESONIC AT-
OMS. S. Deser (Institute for Advanced Study, Princeton,
N. J.), M. L. Goldberger (Univ. of Chicago, Ill.), K. Baumann
(Universität Wien, Austria), and W. Thirring (Physikalisches
Inst., Bern, Switzerland). Phys. Rev. 96, 774-6(1954)
Nov. 1.

The energy level shifts and level widths of the s states of
the π-mesonic atoms are discussed. The discussion is
limited to fairly light nuclei. On the basis of Orear's deter-
mination of the scattering lengths for meson-nucleon scat-
tering, semiquantitative predictions are made. It is pointed

out that even a knowledge of the algebraic sign of the level
would be of value. (auth)

741

INTERACTION OF PROTONS WITH H^3 AND THE EXCITED
STATES OF α PARTICLES. A. I. Baz' and Ya. A. Smoro-
dinskii. Zhur. Eksptl'. i Teoret. Fiz. 27, 382-4(1954) Sept.
(In Russian)

The reactions of protons with H^3 were examined, and it is
shown that the existence of two levels in the systems H^3 + p
explains all experimental data. One level (2^-) has the
energy of approximately 22 Mev, and the other (1^-) is at 1 to
2 Mev. The energy scheme is proposed. (J.S.R.)

742

ON THE MAGNETIC MOMENT OF ODD-ODD NUCLEI. I.
A. Vaisman. Zhur. Eksptl'. i Teoret. Fiz. 27, 386-7(1954)
Sept. (In Russian)

The nuclear magnetic moments of H^2, Li^6, B^{10}, N^{14}, Na^{22},
and K^{40} are calculated by coupling the magnetic moments of
the protons and nucleons. The results agree well with those
obtained by more elaborate calculations. Thus it is shown
that the neutron and proton magnetic moments are additive,
and the moment of the nucleus is caused by the coupling of
the resulting moment of proton and neutron systems.
(J.S.R.)

743

γ RAYS OF Tc^{95}. V. S. Shpinel'. Zhur. Eksptl'. i Teoret.
Fiz. 27, 387-8(1954) Sept. (In Russian)

The Tc^{95} γ rays and their period were measured, and the
results compared with previous work. (J.S.R.)

744

MASS OF INTERMEDIATE ATOMS AND ENERGY BONDS
OF THEIR NUCLEI. V. A. Kravtsov. Uspekhi Fiz. Nauk
57, 1-181(1954) Sept. (In Russian)

A review compiled from publications to Jan. 1, 1954, on
the mass of intermediate atoms and the energy bonds of
their nuclei is presented. 626 references. (J.S.R.)

745

ON THE ASYMMETRY OF FISSION AND THE "SPATIAL"
CONCEPTION OF NUCLEAR LEVELS. Daniel Curie
(Collège de France, Paris). J. phys. radium 15, 733-42
(1954) Nov. (In French)

The difference of mass (asymmetry) of fission fragments
can not be explained by the drop model; this comes essen-
tially from the calculation of masses by the Weiszacker
formula, which involves an error on the energy available in
fission. The fission mechanism proposed rests on the
"spatial" conception of nuclear levels. The experimental
study of nuclear radiation suggests the actual existence of
levels from a geometric point of view. A heavy nucleus
would be composed of several "magic" cores one within the
other. Fission, then, consists in the rupture and regrouping
of the exterior shell covering the core with 50 protons and
82 neutrons, this shell providing the light fragment and the
core the heavy fragment. A theoretical examination, based
on the simplifying idea of nuclear potential in oscillation,
on the extent to which the idea of levels in concentric shells
can be justified is presented. (tr-auth)

746

ON THE JENSEN-MAYER CORRECTION FOR THE MAG-
NETIC MOMENT OF NUCLEI. C. Marty (Collège de
France, Paris). J. phys. radium 15, 783-4(1954) Nov.
(In French)

The correction factor $\Delta\mu$ in the Jensen and Mayer calcu-

lations of the nuclear magnetic moments is shown by recent measurements on the ΔE splitting not always to be as small as was believed. It is shown that the correction term is small for configurations of the type $j = l + 1$, but for configurations of the type $j = l + \frac{1}{2} \Delta\mu$ is most pronounced. (J.S.R.)

747

NUCLEAR ORIENTATION OF ^{54}Mn. M. A. Grace, C. E. Johnson, N. Kurti, H. R. Lemmer, and F. N. H. Robinson (Clarendon Lab., Oxford, England). Phil. Mag. (7) 45, 1192-6(1954) Nov.

Orientation of Mn^{54} at very low temperatures has been attained. The anisotropy of the 0.835 Mev γ radiation emitted in its decay shows that the first excited state of Cr^{54} has spin 2. Detailed interpretation of the results is discussed. (auth)

748

POLARIZED γ-RAYS FROM ORIENTED ^{54}Mn NUCLEI. G. R. Bishop, J. M. Daniels, H. Durand, C. E. Johnson, and J. Perez (Clarendon Lab., Oxford, England). Phil. Mag. (7) 45, 1197-9(1954) Nov.

The plane polarization of the γ ray emitted in the decay of Mn^{54} to Cr^{54} has been measured using nuclei oriented by magnetic hyperfine structure at very low temperatures. It is found that the excited state of Cr^{54} decays by an E2 transition, and it is furthermore concluded that this state has even parity. (auth)

NUCLEAR REACTORS

749

Joint Establishment for Nuclear Energy Research (Norway) THERMAL NEUTRON DISTRIBUTION IN THE CONCRETE SHIELD OF THE JEEP. F. Alder and H. Klepp. Sept. 1954. 5p. (JENER-31)

750

Oak Ridge National Lab.
REACTIVITY MEASUREMENTS WITH THE BULK SHIELDING REACTOR. R. G. Cochran, J. L. Meem, T. E. Cole, and E. B. Johnson. Nov. 19, 1954. 79p. Contract W-7405-eng-26. (ORNL-1682)

Recently several experiments involving reactivity changes of the BSR have been performed with a water-reflected lattice. The regulating rod was calibrated using both the pile-period and the distributed-poison methods. Excellent agreement was found between the pile-period calibration using the inhour formula and the gold-distributed poison, but the use of stainless steel as a distributed poison yielded results difficult to interpret. The BSR safety rods and also the control rods for the Tower Shielding Reactor were calibrated. The measurement of subcritical multiplication as a method of rod calibration was investigated qualitatively and found satisfactory at least for the comparison of different rods. The temperature coefficient of the BSR was measured between temperatures of 23 and 56°C and was found to be nonlinear, at least in this temperature range. Experiments were performed which demonstrated that the negative temperature coefficient of reactivity gives this reactor a high degree of stability at power levels greater than approximately 10 kw. The effect of xenon poisoning was investigated and found to be fairly close to that predicted by calculation. The behavior of the reactor at a power level of one megawatt was studied. There were no signs of boiling, even with only convection cooling. The radiation levels above the water were somewhat above Laboratory tolerance, not because of radiation from the reactor itself, but because the water rising with a relatively high velocity from the reactor core carried the activated N^{16} and sodium in the pool water to the surface rapidly rather than allowing this activity to be dispersed throughout the pool. (auth)

751

ATOMIC RESEARCH REACTORS. Welding J. (N. Y.) 33, 1095-6(1954) Nov.

The "water boiler" and "swimming pool" research reactors are offered for sale by the Babcock and Wilcox Company. The price range is $100,000 to $150,000. The reactors are briefly described. (M.P.G.)

752

[OPERATION OF DISASSEMBLING A CIRCULATING LOOP EXPOSED IN A REACTOR (LITR)]. IN-PILE CIRCULATING LOOP IS DISMANTLED WITH THIS EQUIPMENT. L. N. Howell, A. M. Tripp, and D. T. Jones (Oak Ridge National Lab., Tenn.). Nucleonics 12, No. 11, 76-7(1954) Nov.

753

OPERATIONAL FEATURES OF ZEPHYR. L. R. Shepherd, R. D. Smith, J. E. R. Holmes, H. Rose, and D. D. McVicar (Atomic Energy Research Establishment, Harwell, Berks, England). NUCLEAR ENGINEERING, PART III, Chem. Eng. Progr. Symposium Ser. No. 13, 1-4(1954).

Zephyr, the low-power or zero-energy fast reactor now operating at Harwell has been built with the object of obtaining basic nuclear data needed for fast reactor systems. The reactor has been designed to give as much flexibility as possible from the experimental point of view; it consists of a Pu core surrounded by a U envelope or blanket. The normal operating power is only a few watts; therefore no forced cooling or elaborate shielding is necessary. This makes the problem of access to the reactor much easier. Some results on the relative yields and periods of delayed neutrons obtained with this reactor are given. (auth)

754

RECOMBINATION OF RADIOLYTIC GAS FOR AQUEOUS NUCLEAR REACTORS. Harold M. Busey and R. Philip Hammond (Los Alamos Scientific Lab., N. Mex.). NUCLEAR ENGINEERING, PART III, Chem. Eng. Progr. Symposium Ser. No. 13, 27-38(1954).

A technique for recombining the radiolytic H_2 and O_2 evolved by the Los Alamos Water Boiler fuel solution is used which employs 2 parallel stainless steel catalyst chambers containing platinized alumina pellets. With the reactor operating at 30 kw and a gas flow of 100 liters/min, H_2 content was reduced from 6 to 0.1% after addition of the catalyst. For operation at higher powers, a gas igniter or activated charcoal bed system is discussed. (K.S.)

755

A PILOT PLANT FOR NUCLEAR POWER, THE SGR. William E. Parkins (North American Aviation, Inc., Downey, Calif.). NUCLEAR ENGINEERING, PART III, Chem. Eng. Progr. Symposium Ser. No. 13, 53-65(1954)

At the present time the areas of engineering uncertainties in power-reactor technology are so large that no amount of study can lead to the determination of an optimum reactor type. Similarly, the cost of power from any particular type of reactor plant cannot be reliably established for purposes of comparison with the performance of conventional plants. Since the reactor type is largely determined by the choice of coolant and moderator, an approach is suggested wherein

these are selected strictly on the basis of available materials and independent of any particular configuration. The problems of incorporating the chosen coolant and moderator into a practical high-performance design can then be undertaken. Proceeding with this approach, all coolant and moderator materials which have been suggested for power reactors are briefly compared. A basis is indicated for selecting sodium coolant and graphite moderator. Design problems of a large sodium-graphite power reactor and its cooling system are discussed, and solutions are suggested in the form of such recommended features as the method of coolant manifolding, type of reactor fuel, control- and safety-element arrangement, over-all shielding configuration, and choice of heat exchangers. The general type of design described is believed to have good safety features and to be capable of producing low-cost electrical power. In order to establish reliable cost information and plant operating characteristics, a pilot plant, the SGR, is recommended for construction and operation. (auth)

756

A CURRENT DESIGN FOR A FULL-SCALE REACTOR POWER PLANT. T. G. LeClair (Commonwealth Edison Company, Chicago, Ill.). NUCLEAR ENGINEERING, PART III, Chem. Eng. Progr. Symposium Ser. No. 13, 122-8(1954).

A summary of the Nuclear Power Group industrial participation study on the economic design of nuclear power reactors is given. The reactor selected is a natural-U, D_2O design of 50,000 kw capacity. (K.S.)

757

THE EXPERIMENTAL BREEDER REACTOR. H. V. Lichtenberger (Argonne National Lab., Lemont, Ill.). NUCLEAR ENGINEERING, PART III, Chem. Eng. Progr. Symposium Ser. No. 13, 139-46(1954).

The basis for the design of the Experimental Breeder Reactor is discussed along with the details of construction and the constants of the reactor. The cooling system and the plant layout are described. The concepts of breeding gain and specific power are discussed along with the significance of the development. (auth)

758

HETEROGENEOUS REACTORS WITH REFLECTOR. A. Medina and F. E. Prieto (Instituto Nacional de la Investigacion, Cientifica, Mexico). NUCLEAR ENGINEERING, PART III, Chem. Eng. Progr. Symposium Ser. No. 13, 147-8 (1954).

The purpose of this paper is to present the method and the equations that we have used in order to calculate heterogeneous reactors formed by a definite lattice surrounded by a reflector. Medina has shown that by a systematic averaging process applied to a heterogeneous reactor, and by the use of suitable constants, which may be called the "homogenized constants of a heterogeneous reactor," it is possible to reduce the equations of a heterogeneous reactor to a form completely similar to those of a homogeneous reactor. Furthermore, using for the physical constants the values corrected by transport theory, and taking into account the finite size of the reactor in the calculation of the reflector effect, a set of equations is obtained giving good agreement with experiment for thermal reactors. (auth)

759

MATERIALS TESTING REACTOR STRUCTURE TEMPERATURES. G. H. Hanson, A. V. Grimaud, and K. A. McCollom (Philips Petroleum Company, Idaho Falls). NUCLEAR

ENGINEERING, PART III, Chem. Eng. Progr. Symposium Ser. No. 13, 149-66(1954).

The Materials Testing Reactor is a high-flux reactor which is used to make tests in connection with the reactor development program, to produce special radioisotopes, and to obtain nuclear cross sections. The design power level is 30 Mw. The fuel and the beryllium reflector are located in a tank system and are water cooled. Surrounding the tank is an air-cooled graphite reflector which is bounded by a thermal shield consisting of two concentric steel cubical shells between which flows cooling air. Beyond this is the concrete biological shield which is pierced with numerous holes giving access to regions near the reactor core. This discussion is concerned entirely with the temperatures outside the reactor tank. The operating temperatures within the tank, except for fuel, are about 100°F. A typical set of reactor-structure temperatures (exterior to the tank) at full power is presented. The temperature distributions within the graphite reflector, across the thermal shield, and in the biological shield are shown. The effects of reactor operating conditions, lattice loadings, and irradiation experiments on structure temperatures are discussed. No excessive operating temperatures were encountered at full power. The highest temperature observed (215°F) was in the graphite-ball zone. The temperature differences within the thermal shield and the biological shield were less than the maximum allowable from thermal-stress considerations; their operating temperatures were mild, the maximum temperature being 110°F. (auth)

NUCLEAR TRANSFORMATION

760

Radiation Lab., Univ. of Calif., Berkeley
PHOTODISINTEGRATION OF CARBON-12 BY 300-MEV BREMSSTRAHLUNG (Part A of thesis). Sheldon Dorman Softky. Oct. 8, 1954. 26p. Contract W-7405-eng-48. (UCRL-2753)

The yield of stars due to the reaction $C^{12}(\gamma, 3\alpha)$ from 330-Mev bremsstrahlung has been measured. Ilford C2 emulsions 600μ thick were exposed to the beam of the Berkeley synchrotron and scanned for three-prong stars. Those stars satisfying conditions for conservation of momentum in the process $(\gamma, 3\alpha)$ were accepted, and an excitation function for this reaction was obtained. Since no stars were found from quanta above 42 Mev, an upper limit for the cross section above this energy was obtained. The results are in agreement with those obtained with lower-energy synchrotrons and show that there are no prominent resonances below 100 Mev other than those already known. (auth)

761

ANGULAR DISTRIBUTION OF NEUTRONS FROM THE REACTION $^{11}B(d,n)^{12}C$ AT 0.85 MEV BOMBARDING ENERGY. Arnfinn Graue (Fysisk Institutt, Norway). Phil. Mag. (7) 45, 1205-9(1954) Nov.

Angular distributions and energy spectra of neutrons from $B^{11}(d,n)C^{12}$ have been measured at 0.85 Mev bombarding energy, using the photographic plate technique. Energy levels in C^{12} are found at 4.4, 7.7, 9.6, and 12.7 Mev. The stripping process is suggested to be responsible for a large part of the neutron yield. The orbital angular momentum of the captured proton has been determined as $l_p = 1$ and 2 for the 4.4 Mev and 9.6 Mev level, respectively. (auth)

762

PROTON ANGULAR DISTRIBUTIONS FROM DEUTERON BOMBARDMENT OF Bi^{209}, Pb^{207}, and Y^{89}. N. S. Wall (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 96, 670-3(1954) Nov. 1.

The proton angular distributions in the (d,p) reactions on Bi^{209}, Pb^{207}, and Y^{89} have been measured, and an attempt made to interpret the results on the basis of the Butler stripping theory. The neutron added to Y^{89} is consistent with an $l_n = 2$ prediction. The last neutron in Pb^{208} shows a similarity to an $l_n = 1$, non-Coulomb theory angular distribution, but the Bi^{210} case is not readily capable of being interpreted with this theory. The results of these experiments are analyzed on the basis of the shell model and the systematics of the binding energy of the last neutron. (auth)

763

DISINTEGRATION OF Li^6 AND Li^7 BY 0.24-MEV TRITONS. K. W. Allen, E. Almqvist, J. T. Dewan, and T. P. Pepper (Atomic Energy of Canada, Ltd., Chalk River, Ontario). Phys. Rev. 96, 684-9(1954) Nov. 1.

The energy distributions of charged particles emitted in the bombardment of Li^6 and Li^7 by 0.24-Mev tritons have been obtained by magnetic analysis and by measuring pulse heights in a proportional counter. Q values for the reactions $Li^6(t,d)Li^7$, $Li^6(t,p)Li^8$, and $Li^7(t,\alpha)He^6$ were found to be 0.986 ± 0.007, 0.790 ± 0.011, and 9.79 ± 0.03 Mev, respectively. The latter, when combined with other accurately measured Q values, leads to a $He^6 - Li^6$ mass difference of 3.55 ± 0.03 Mev, which is an agreement with the most recent β-ray measurements. Evidence is also presented for an excited state of He^6 at 1.71 ± 0.01 Mev above the ground state. (auth)

764

γ RAYS FROM THE $C^{13}(p,\gamma)N^{14}$ AND $Na^{23}(p,\gamma)Mg^{24}$ REACTIONS. B. Hird, C. Whitehead, J. Butler, and C. H. Collie (Clarendon Lab., Oxford, England). Phys. Rev. 96, 702-3 (1954) Nov. 1.

The γ rays from the 554-kev resonance of $C^{13}(p,\gamma)N^{14}$ and the 310-kev resonance of $Na^{23}(p,\gamma)Mg^{24}$ have been measured with a three-crystal pair spectrometer. Energies and intensities were measured, and cascades detected by coincidence measurements. The 5.7-Mev γ ray from $C^{13}(p,\gamma)N^{14}$ is 0.7 ± 0.6 percent of the intensity of the main 8.05-Mev radiation. The most intense radiation from $Na^{23}(p,\gamma)Mg^{24}$ was the 1.38-Mev line, and no 2.76-Mev radiation was observed. (auth)

765

RESONANCES IN $Li^7(p,n)Be^7$. Robert K. Adair (Univ. of Wisconsin, Madison and Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 96, 709-12(1954) Nov. 1.

An investigation of experimental data concerning the $Li(p,n)$ reaction indicates that the resonance at 2.25-Mev proton energy is due to the influence of a spin 3, isotopes spin 1, even parity level of Be^8, 19.2 Mev above the ground state, and that the background reaction intensity is predominantly the result of a spin-1 state of odd parity, and a spin-2 state of odd parity and isotopic spin 0. Cross sections, angular distributions, and neutron polarizations calculated on this basis are in good agreement with previous experimental measurements of these quantities. The neutron and proton widths of the isotropic spin-1 state in Be^8 are related to the neutron width of the corresponding isotopic-spin-1 state of Li^8, 2.3 Mev above the ground state, in

a manner consistent with the transition probability relationships expected of a nuclear isotopic spin multiplet. (auth)

766

ENERGY DISTRIBUTION OF NUCLEAR REACTION PRODUCTS. H. H. Barschall and J. L. Powell (Univ. of Wisconsin, Madison). Phys. Rev. 96, 713(1954) Nov. 1.

In a reaction involving two product particles the distribution in energy of either product particle measured in the laboratory system is the same as the distribution in angle in the zero-momentum system. This relation is valid relativistically and irrespective of the reaction energy. Some applications are discussed. (auth)

767

EMISSION OF HIGH-ENERGY GAMMA LINE FROM C^{12}. David Cohen, Burton J. Moyer, Harlan Shaw, and Charles Waddell (Univ. of California, Berkeley). Phys. Rev. 96, 714-15(1954) Nov. 1.

A γ ray of energy 15.2 Mev has been observed with a 180° pair spectrometer in the bombardment of C by protons of energy 30 to 340 Mev. The line is also seen in deuteron bombardment of B^{11} but not of B^{10}. These facts, along with energetics arguments and clear spectrometer separation from known lines in excited Be^8, strongly indicate all excited C^{12} origin for the line. It is tentatively proposed that the excited C^{12} level here involved is a $T = 1$ state for which isotopic spin selection rules forbid a disintegration into three γ particles. (auth)

768

SHORT-LIVED RADIO-NUCLIDES PRODUCED BY A SYNCHROCYCLOTRON. H. Tyrén and P. A. Tove (Univ. of Uppsala, Sweden). Phys. Rev. 96, 773-4(1954) Nov. 1.

A method of studying short-lived radionuclides produced by the internal beam in a synchrocyclotron is described. Preliminary results on a number of proton-produced activities in the mass range below 70 are given. (auth)

769

SEARCH FOR 15-MEV GAMMA RADIATION FROM $N^{14} + d$ and $Be^9 + \alpha$. V. K. Rasmussen, John R. Rees, M. B. Sampson, and N. S. Wall (Indiana Univ., Bloomington). Phys. Rev. 96, 812-13(1954) Nov. 1.

Cohen, Moyer, Shaw, and Waddell (Phys. Rev. 95, 664(A) (1954)) have recently reported 15.2-Mev γ radiation from the bombardment of carbon with protons and of B^{11} with deuterons, but not from the bombardment of Be with α's They suggest that the state in C^{12} involved is the isotopic spin $T = 1$ analog of the ground states of B^{12} and N^{12}. The isotopic spin selection rules would then forbid the production of this state in in the $N^{14}(d, \gamma)$ reaction. This paper reports a attempt to verify this. (L.T.W.)

PARTICLE ACCELERATORS

770

[European Council for Nuclear Research]
MEASURES DU CHAMP SUR LA MAQUETTE AC III/B. (Field Measurements on the AC III/B Mockup). G. Brianti, P. Denis, G. Germain, B. de Raad, G. Petrucci, L. Resegotti, A. Sarazin, and J. P. Stroot. Oct. 1954. 10p. (CERN-PS/MM-6)

A group of magnetic field measurements have been made at several locations in a model magnet design for the CERN synchrotron. The results are graphically presented. (K.S.)

771

European Council for Nuclear Research
INJECTION DANS LE SYNCHROTRON—RECHERCHE
D'UN DISPOSTIF DE DEFLECTION. (Synchrotron In-
jection—Research on a Method of Deflection). Oct. 1954.
27p. (CERN-PS/PL-1)

Problems connected with injection of a proton beam into
the proposed CERN synchrotron are discussed. Deflection
of the beam into the machine by electrostatic and magnetic
means are considered. (K.S.)

772

Microwave Lab., Stanford Univ.
A STUDY OF MULTI-BEV LINEAR ELECTRON
ACCELERATORS. R. L. Kyhl. June 1954. 31p. Contract
(AT(04-3)-21. (ML-240)

Construction and maintenance costs for a large linear
electron accelerator are discussed on the basis of ex-
perience obtained with the Stanford Mark III accelerator.
(K.S.)

773

Radiation Lab., Univ. of Calif., Berkeley
INDEX TO INFORMATION AVAILABLE ON THE
CROCKER 60-INCH CYCLOTRON. July 30, 1954. 12p.
Contract W-7405-eng-48. (UCRL-1651(2nd rev.))

RADIATION ABSORPTION AND SCATTERING

774

Livermore Research Lab., Calif. Research and Develop-
ment Co.
MIGRATION AREA OF POLONIUM-BERYLLIUM NEU-
TRONS IN WATER. R. H. Graham, J. R. Donaldson, S. H.
Fitch, J. W. Flora, and R. E. Nather. May 13, 1953.
Decl. Nov. 2, 1954. 26p. Contract AT(11-1)-74. (MTA-
45)

The radial distribution of neutrons from a strong
polonium-beryllium source has been studied in a large
volume of water, and apparent slowing down areas and
migration areas calculated. These measurements have
been checked against smaller sources in lesser volumes of
water and against data taken by other experimenters.
Indium foil detectors, bare and cadmium covered, were
employed. Data with the best statistics show the neutron
age to indium resonance (1.44 ev) as 56.3 cm^2 and migra-
tion area to total indium activation as 64.7 cm^2. (auth)

775

Nevis Cyclotron Labs., Columbia Univ.
THEORY OF MULTIPLE COULOMB SCATTERING FROM
EXTENDED NUCLEI. Leon N. Cooper and James
Rainwater. Aug. 1954. 53p. Sponsored by ONR and AEC
under Contract N6-ori-110, Task No. 1. (NEVIS-4; CU-70-
54-ONR-110-1-Phys.)

Two independent methods are described for calculating
the multiple scattering distribution for projected angle
scattering resulting when very high energy charged par-
ticles traverse a thick scatterer. The single scattering law
for projected angle scattering is taken to be the Rutherford
scattering law for projected angle scattering modified at
small angles by electron shielding and at large angles by a
nuclear form factor $F_n(\varphi/\varphi_o)$ which gives the effect of the
finite nuclear size. The calculations can be carried through
for any reasonable choice of F_n and have been carried
through for two suggested choices for F_n for the examples
of fast μ-meson scattering in 2-cm and 5-cm thick lead

slabs, with good agreement for the two methods of calcula-
tion. The results are compared with the theories of
Molière and Olbert. (auth)

776

Carnegie Inst. of Tech.
PROTON-PROTON SCATTERING AT 437 MEV. R. B.
Sutton, T. H. Fields, J. G. Fox, J. A. Kane, W. E. Mott,
and R. A. Stallwood. Oct. 8, 1954. 35p. Contract AT(30-
1)-882. (NYO-6538)

Measurements of the angular distribution of proton-
proton scattering at 437 Mev are reported. A description
is given of the external proton beam: its collimation,
angular spread, energy spectrum, and intensity. The count-
ers, electronics, and targets are described. Two scattering
arrangements were used. In one the polyethylene-carbon
subtraction method with coincidence detection of the
scattered and recoil protons was employed. In the other a
counter telescope detected the protons emerging at a
given angle from a liquid hydrogen target; at the larger
angles but not at the smaller the scattered pairs could also
be detected by coincidences between the telescope and
another counter. At the smaller angles, when coincidence
counting could not be used to insure detection of elastic
p-p scattering, precautions were taken to absorb the
particles produced in inelastic p-p collisions. The results
are that the differential cross section for elastic proton-
proton scattering rises smoothly from its value at 90° c.m.
to a value about 20% higher at 17° c.m. The value at 90°
c.m. is 3.49 ± 0.17 mb/ster. (auth)

777

Carnegie Inst. of Tech.
MESON INTERACTIONS IN NUCLEAR EMULSIONS.
Leonard Andrew Mann. June 1954. 61p. Contract AT(30-
1)-882. (NYO-6567)

Nuclear emulsions were exposed to the pion beams of
various energies from the Carnegie Institute of Technology
synchrocyclotron, and the interactions of the pions with
the nuclei of the emulsions were observed. In scanning
133.4 meters of track linearly, 23 elastic pion-proton
scatterings were found, giving a mean free path of 5.8
meters. In this same track length 479 stars, including
inelastic scatterings, were found. This gives a mean free
path for the stars of 27.9 cm. A comparison of the general
features of these stars with those found at other energies
indicates that the dependence upon pion energy is slight.
The production cross section for stars seems to decrease
at the rate expected by the geometrical cross section of
the nuclei as the pion energy increases. The increase in
the number of prongs in positive pion-induced stars over
those in stars induced by negative pions is about one half
prong per star. The prongs in all stars at all energies show
an almost isotropic angular distribution. There is a slight
forward tendency (about 55% forward and 45% backward).
(auth)

778

Radiation Lab., Univ. of Calif., Berkeley
ATTENUATION AND HIGH ENERGY NEUTRON PRODUC-
TION MEASUREMENTS FOR 190 MEV DEUTERONS AND
340 MEV PROTONS. William J. Knox. Aug. 29, 1951.
Decl. Sept. 28, 1954. 21p. Contract W-7405-eng-48.
(UCRL-1427)

The attenuation of 190-Mev deuterons by Be, C, and U
and 340-Mev protons by U absorbers has been measured.
Attenuation measurements were made by measuring the

charge collected on a Faraday cup, with and without the absorbers. An attempt was made to measure the absolute neutron yields from C targets bombarded by deuterons and Be targets bombarded by protons. (K.S.)

779

Westinghouse Atomic Power Div.
FLUX FROM HOMOGENEOUS CYLINDERS CONTAINING UNIFORM SOURCE DISTRIBUTIONS. J. J. Taylor and F. E. Obenshain. Dec. 7, 1953. Decl. Aug. 3, 1954. 71p. Contract AT-11-1-GEN-14. (WAPD-RM-213)

An exact description is developed of the particle flux from a shielded right circular cylinder of infinite length containing a uniformly distributed isotropic source. The expression is applicable to shielding and related problems in which the basic radiation attenuation law is exponential.. Numerical results are provided in tabular and graphical form over a wide range of values of (a) the cylinder radius and self-absorption coefficient, (b) the shield attenuation coefficient and thickness, and (c) the distance from the surface of the cylinder. (auth)

780

IONIZATION PRODUCED BY 5-MEV ALPHA PARTICLES IN ARGON MIXTURES. C. E. Melton, G. S. Hurst, and T. E. Bortner (Oak Ridge National Lab., Tenn.). Phys. Rev. 96, 643-5(1954) Nov. 1.

It is shown that when small amounts of impurities are added to argon extra ionization is produced by alpha particles moving through the gas. These effects are studied as a function of the ionization potential of the added impurity, and it is found that the ionization increases even when the ionization potential is much higher than the well known metastable state of argon. (auth)

781

ELECTRIC EXCITATION OF Au^{197}. C. F. Cook, C. M. Class, and J. T. Eisinger (Rice Inst., Houston, Texas). Phys. Rev. 96, 658-63(1954) Nov. 1.

The gamma radiation emitted from Au^{197} following the electric excitation of the nucleus by protons of from 2 to 5 Mev has been studied. The angular distributions and absolute yields of the two intense gamma rays of the spectrum at 279 and 555 kev have been measured. The angular distributions of these two gamma rays were found to agree well with those calculated for 5/2 → 3/2 (M1 + E2) and 7/2 → 3/2 (E2) transitions, respectively, the excitation being E2 in both cases. The yield from the 279-kev state was observed to increase with beam energy in the manner predicted by theory for electric quadrupole excitation. On the basis of the Bohr-Mottelson unified model of the nucleus the results indicate a larger than expected cross section for the formation of the 555-kev state. Values for the quadrupole moment and magnetic moment of the ground state of gold calculated from the cross section for the formation of the 279-kev state agree with spectroscopic values. (auth)

782

DETERMINATION OF THE RANGES AND STRAGGLING OF LOW-ENERGY ALPHA PARTICLES IN A CLOUD CHAMBER. S. Barile, R. Webeler, and G. Allen (National Advisory Committee for Aeronautics, Cleveland, Ohio). Phys. Rev. 96, 673-8(1954) Nov. 1.

Ranges of 105 alpha particles with energies of 0.48, 0.545, and 0.615 Mev as fixed by a velocity selector have been measured by the use of a low-pressure cloud chamber. From the results of these measurements the average ranges R_{Av} and the straggling coefficients in air at 15° and 760 mm were calculated for these three energies. The values of R_{Av} were found to be respectively 0.299, 0.327, and 0.354 cm; and the values of the standard deviation were respectively 0.011, 0.0135, and 0.010 cm. After a correction to take into account the difference in definition, the R_{Av}'s are two to three percent higher than those following from a range-energy curve given by Bethe. (auth)

783

RESONANCE SCATTERING OF GAMMA RAYS BY NUCLEI. A. M. Cormack (Univ. of Cape Town, South Africa). Phys. Rev. 96, 716-18(1954) Nov. 1.

Two methods of observing the nuclear resonance scattering of gamma rays are discussed: one using gamma rays which arise from transitions to the ground state of a nucleus which is the same as the one in which the scattering is being observed, and the other using gamma rays of small energy spread and variable mean energy obtained by means of Compton scattering. (auth)

784

NEUTRAL PION-DEUTERON PRODUCTION IN 400-MEV n-p COLLISIONS. R. A. Schluter (Univ. of Chicago, Ill.). Phys. Rev. 96, 734-42(1954) Nov. 1.

The reaction $n + p \rightarrow d + \pi^0$ has been studied in a high-pressure hydrogen-filled diffusion cloud chamber. A total of 102 deuterons were identified by a technique of ionization measurement in conjunction with momentum measured in the 10,500-gauss magnetic field. From the laboratory deuteron angle and momentum, the pion angle and the incident neutron energy can be deduced with good resolution, provided the pion is emitted backward in the center-of-mass system. Proton recoils were observed simultaneously, from which the incident neutron flux and energy spectrum were determined. The energy spectrum is centered at 400 Mev with a spread of ± 25 Mev. From 52 events occurring in the backward direction the angular distribution of pion emission was found to be consistent with $(0.28_{-0.14}{}^{+0.26} + \cos^2 \bar{\psi}_\pi)$, where the limits include 70 percent of the probability and $\bar{\psi}_\pi$ is the pion angle in the center-of-mass system. The observed excitation function and total cross section determined from 60 events is consistent with $(0.47 \pm 0.08)\eta^3$ millibarn, where η is the center-of-mass pion momentum in rest mass units. These results agree, within the accuracy of the measurements, with the prediction of charge independence that the ratio of this reaction to $p + p \rightarrow d + \pi^+$ should be $\frac{1}{2}$. Eight cases of internal conversion of the neutral pion were seen, four accompanied by deuterons and four by protons, the later giving evidence on neutral pion creation with unbound final nucleons. (auth)

785

NUCLEAR MULTIPOLE TRANSITIONS IN INELASTIC ELECTRON SCATTERING. L. I. Schiff (Stanford Univ., Calif.). Phys. Rev. 96, 765-72(1954) Nov. 1.

Expressions are obtained for the differential cross sections for inelastic scattering of fast electrons with excitation of various nuclear multipole transitions. The most probable transitions are those that involve collective motion of many nucleons, and in this case the term arising from the transition charge density dominates those that come from the current and magnetization densities. There is then a close relation between the probability for inelastic electron scattering and the probability for the corresponding radiative electric multipole transition, although an assump-

tion must be made as to the shape of the transition charge density. This is illustrated with a detailed discussion of the collective electric quadrupole transitions, using the model of Bohr and Mottelson. When the transition is produced by one or a small number of nucleons, or when it is of magnetic multipole type, there is likely to be little relation between inelastic scattering and radiation probabilities. The electric monopole transition $(0 + \rightarrow 0 +)$ is also discussed. It is shown how the elastic scattering can be corrected for unresolved inelastic scattering as well as elastic quadrupole scattering before an analysis is made in terms of the spherically symmetric part of the static nuclear charge density, and also how the strength as well as the shape of the transition charge density can be determined experimentally when only relative measurements of inelastic scattering are available. (auth)

786

FORMULA FOR POLARIZATION IN NUCLEON-NUCLEON SCATTERING. G. Breit and J. B. Ehrman (Yale Univ., New Haven, Conn.). Phys. Rev. 96, 805-6(1954) Nov. 1.

General expressions for the calculation of polarization effects are available, but the work involved in the transition to special forms containing phase shifts is sometimes large. In this paper the general expressions are reduced to a point representing a compromise between compactness and explicitness. (L.T.W.)

787

FORMULA FOR POLARIZATION IN p-p SCATTERING FOR P AND F WAVES. M. H. Hull, Jr. and A. M. Saperstein (Yale Univ., New Haven, Conn.). Phys. Rev. 96, 806(1954) Nov. 1.

An expression for the calculation of polarization of protons produced by single scattering taking into account P and F waves has been worked out. Coupling between $^3P_2$ and $^3F_2$ is neglected, but otherwise the most general condition describable by a set of phase shifts for states of definite orbital as well as total angular momentum is considered. The result is written in a form convenient for numerical work. (L.T.W.)

788

PHASE SHIFTS FOR NUCLEON-NUCLEON SCATTERING AT 280 MEV. G. Breit, J. B. Ehrman, A. M. Saperstein, and M. H. Hull, Jr. (Yale Univ., New Haven, Conn.). Phys. Rev. 96, 807(1954) Nov. 1.

Recent data on nucleon-nucleon scattering at 280 Mev, indicating the presence of phase shifts for orbital angular momenta $L > 1$ at this energy, are examined. (L.T.W.)

789

POLARIZATION OF HIGH-ENERGY PROTONS IN ELASTIC SCATTERING ON HELIUM AND CARBON. O. Chamberlain, E. Segrè, R. Tripp, C. Wiegand, and T. Ypsilantis (Univ. of Calif., Berkeley). Phys. Rev. 96, 807-9(1954) Nov. 1.

The elastic scattering cross sections of He for 315-Mev 74% polarized protons and of C for 290-Mev 64% polarized protons are reported. (L.T.W.)

790

REACTION $p + p \rightarrow \pi^+ + d$ WITH POLARIZED PROTONS. T. H. Fields, J. G. Fox, J. A. Kane, R. A. Stallwood, and R. B. Sutton (Carnegie Inst. of Tech., Pittsburgh, Penna.). Phys. Rev. 96, 812(1954) Nov. 1.

The 45% polarized proton beam of the Carnegie synchrocyclotron has been used to measure the azimuthal asymmetries of the reaction $p + p \rightarrow \pi^+ + d$ at π^+ c.m. angles of 90 and 50°. The polarized external beam of 415 ± 5 Mev protons impinged upon liquid H, and the resulting pions were detected in fast coincidence with their associated deuterons. (L.T.W.)

791

THE ABSORPTION OF HOMOGENEOUS ELECTRONS IN ALUMINUM. G. Backenstoss (Universität Freiburg i. Br., Germany). Z. Naturforsch. 9a, 886-90(1954) Oct. (In German)

The measured linear decrease of the number of particles in the passage of monoergic electrons through Al was explained by multiple scattering, the Bothe theory of radiation absorption, and the energy loss. It is shown that the curve is linear only at certain electron energies. A comparison of the measured with the calculated curve allows the determination of the intensity ratios of different electron components. The agreement of theory and experiment was shown. (tr-auth)

792

THE CROSS-SECTIONS AND ANGULAR DISTRIBUTIONS OF THE D-D REACTIONS BETWEEN 150 AND 450 keV. G. Preston, P. F. D. Shaw, and S. A. Young (Oxford Univ., England). Proc. Roy. Soc. London 226A, 206-16(1954) Nov. 9.

A thin gas target was used and the He^3 and H^3 particles from the reactions were counted in two proportional counters which were rotated to make angles between 20 and 135° (in the center-of-mass system) with the incident deuteron beam. In contradiction to data previously published for this energy range, the angular distributions of the reactions are different, the asymmetry of the neutron-producing reaction being the greater. The total cross section of the neutron reaction is greater than that of the proton reaction; the ratio of the cross sections increases with bombarding energy. (auth)

793

MULTIPLE PRODUCTION OF PIONS IN PION-NUCLEON COLLISIONS. E. Fermi (Univ. of Chicago, Ill.). Anais acad. brasil. cien. 26, 61-3(1954) Jan.

The multiple production of pions in pion-nucleon collisions with a laboratory energy of the order 1 bev is discussed from statistical theory. (auth)

794

NUCLEAR DISINTEGRATION ENERGIES. D. M. Van Patter (Univ. of Minnesota, Minneapolis) and Ward Whaling (California Inst. of Tech., Pasadena). Revs. Mod. Phys. 26, 402-43(1954) Oct.

This compilation of nuclear reaction energies was undertaken to provide a systematic and comprehensive survey of the present state of our experimental knowledge of the energy released in nuclear reactions. The table also affords convenient reference to the large number of experimental results scattered throughout the literature. In view of the rapid accumulation of new results, an up-to-date revision is felt to serve a useful purpose. (auth)

795

INTERACTION OF 19 MEV DEUTERONS WITH CARBON. R. G. Freemantle (Univ. of Birmingham, England), W. M. Gibson (Queen's Univ. of Belfast), and J. Rotblat (St. Bartholomew's Hospital Medical Coll., London, England). Phil. Mag. (7) 45, 1200-4(1954) Nov.

The results of the bombardment of C^{12} by 19 Mev deuterons identify one group of deuterons experiencing elastic

scattering and two inelastic groups corresponding to the energy levels of C^{12} at 4.43 and 9.61 Mev. Several proton groups are identified as originating from the C^{12}(d,p) reaction and corresponding to different energy states of C^{13}. Angular distributions for the groups are given. (M.P.G.)

796

THE ELASTIC SCATTERING OF PROTONS BY FLUORINE. G. Dearnaley (Cavendish Lab., Cambridge, England). Phil. Mag. (7) 45, 1213–16(1954) Nov.

The differential elastic scattering cross section of fluorine for protons has been measured at four angles, with bombarding energies from 0.5 to 2.1 Mev. Anomalies were observed corresponding to the resonances in F^{19} + p at 669, 831, 874, 935, 1355, 1381, 1431, 1690, 1940, and 2030 kev. (auth)

797

POLARIZATION OF BREMSSTRAHLUNG. E. G. Muirhead and K. B. Mather (Univ. of Melbourne, Australia). Australian J. Phys. 7, 527–9(1954) Sept.

798

RELATIVE CROSS-SECTION OF (n,p)-REACTION IN Al^{27} AND Mg^{24}. S. K. Nandi and N. K. Saha (Univ. of Delhi, India). Indian J. Phys. 28, 396–402(1954) Aug.

Fast neutrons from a 100-mg (Raα + Be) source are used to determine the relative cross section of the (n,p)-reactions in Al^{27} and Mg^{24} by the method of the 'threshold detector,' following previous work on S^{32} and P^{31}. Rates of β disintegrations from Mg^{27} (T = 10 min) and Na^{24} (T = 14.8 hrs) formed in the reactions are measured under identical geometry. Methods for applying corrections for self absorption of the β rays in the active sample and from other causes are discussed. The relative cross sections with respect to the S^{32} (n,p) reaction are obtained as 0.11 for Al^{27} and 0.14 for Mg^{24}, showing a reasonably good agreement with the values obtained by Cohen. The importance of these results in interpreting the nuclear level structure is discussed. (auth)

RADIATION EFFECTS

799

Livermore Research Lab., Calif. Research and Development Co.
THE EFFECT OF NEUTRON FLUX ON THE MECHANICAL PROPERTIES OF ALUMINUM ALLOYS. R. V. Steele and W. P. Wallace. May 1954. Decl. Sept. 20, 1954. 21p. Contract AT(11-1)-74. (LRL-145)

Aluminum alloys 2SO 2SH14, 52SO, 52SH34, 61SO, 61ST6, and A54S were irradiated at a maximum temperature of 150°F to a total neutron irradiation of 1.26×10^{21} neutrons/cm^2 in order to determine the effect of neutron irradiation on the mechanical properties. It was determined that the flow stress was increased markedly, particularly for the soft tempers, by the neutron exposure. The usual tensile strength was increased by the irradiations, whereas, the percentage of elongation was decreased, but not in every case. For the same value of increase in flow stress (or the usual tensile strength), the ductility, as measured by the percentage of elongation, is markedly greater when this increase in accomplished by neutron exposure rather than by mechanical strain hardening. For a given true stress of 0.05 true strain, the strain hardening exponent is greater for irradiated specimens than for control specimens. Also, for a given value of unstrained strength, the strain harden-

ing exponent is greater for irradiated specimens than for control specimens. (auth)

800

Carnegie Inst. of Tech.
RADIATION EFFECTS IN SOLIDS. PROGRESS REPORT FOR JANUARY 1 TO JULY 1, 1954. R. Smoluchowski, W. Leivo, H. Ingham, P. Mitchell, E. A. Pearlstein, and W. Vaughan. Sept. 24, 1954. 8p. Contract AT-(30-1)-1193. (NYO-3131)

Large effects of proton and of gamma irradiation on electrical conductivity of alkali halides were observed and studied during continuous heating. A tentative interpretation is suggested. Measurements of mechanical properties are still hampered by lack of reproducibility. Study of surface effects by means of multiple beam interferometry was completed. Optical absorption measurements on alkali halides and on sapphire are continuing and so does small-angle x-ray scattering in diamond. The dependence of resistivity increase in tungsten upon the energy of the incident protons is being studied in order to verify the proposed role of star formation in radiation effects. (For preceding period see NYO-3129.) (auth)

801

PRODUCTION AND BLEACHING OF COLOR CENTERS IN X-RAYED ALKALI HALIDE CRYSTALS. I. L. Mador, R. F. Wallis, M. C. Williams, and R. C. Herman (Johns Hopkins Univ., Silver Spring, Md.). Phys Rev. 96, 617–28 (1954) Nov. 1.

The x-ray production and optical and thermal bleaching of color centers in NaCl and LiF have been studied quantitatively in regions of substantially uniform concentration by making optical absorption measurements in a direction perpendicular to the axis along which the crystals were x rayed. At room temperature F center growth rate for short x-ray exposures is found to be proportional to the rate of absorption of x rays. For long exposures the rate of growth of the F band increases greatly near the x-rayed surface. Large M band growth accompanies this increased F band growth. The rate of bleaching of F centers by F light in NaCl has been studied at room temperature for low concentrations where the light absorption is nearly uniform along the light path. Differential equations describing the rates of excitation of F center electrons to the conduction band and the trapping of conduction electrons by negative ion vacancies and holes have been integrated under special conditions. The results are found to be consistent with the experimental data. The rate of thermal bleaching of F centers in NaCl has been studied at temperatures up to 150°C. It has not been found possible to analyze the data in terms of a mechanism involving trapping of conduction electrons by negative ion vacancies and holes. The results of several qualitative experiments to investigate the possible formation of vacancies during x raying are presented. (auth)

RADIOACTIVITY

802

Ames Lab.
RADIATIONS FROM CERIUM^{141}. James Jones, Jr. and Erling Jensen. Jan. 15, 1954. 41p. Contract W-7405-eng-82. (ISC-515)

The β spectrum of Ce^{141} was examined with a thin-lens spectrometer and an intermediate-image spectrometer adapted for coincidence measurements. The β decay was found to be complex with two β groups of maximal energies

574 3 kev and 431 2 kev. The data obtained indicated the
presence of a single γ ray. Coincidence measurements in-
ferred that the γ was in coincidence with the lower-energy
β group. Gamma-ray spectra obtained with a scintillation
spectrometer and a thin-lens spectrometer indicated that
only one γ ray is present in Ce^{141}. Transitions ascribed to
the higher- and lower-energy β groups are $\Delta I = -1$, "yes"
and $\Delta I = 0$, "yes" respectively. The γ ray is probably
magnetic dipole radiation. An $f_{7/2}$ state, with odd parity, is
assigned to the ground state of Ce^{141}; a $g_{7/2}$ state, with even
parity, is assigned to the first excited state of Pr^{141}. In
addition, a coincidence scintillation counter was tested in
the thin-lens spectrometer by examining the β spectrum of
P^{32}. The counter makes use of two photomultipliers with
the light from the scintillator being divided between the two
phototubes, which were operated at room temperature in
the investigation. Preliminary results indicated that it was
not feasible to obtain both a low background counting rate
and a suitable energy cut-off, because of the low efficiency
of the optical system. The energy cut-off for the counter
could probably be decreased by use of a different shielding
arrangement which does not require Lucite light pipe ex-
tensions; however, it is believed that a cut-off lower than
10 kev probably could not be obtained. (auth)

803

NEW CHAIN BARIUM-126—CESIUM-126. M. I. Kalkstein
and J. M. Hollander (Univ. of California, Berkeley). Phys.
Rev. 96, 730-4(1954) Nov. 1.

The neutron-deficient chain $Ba^{126} - Cs^{126}$ has been pro-
duced from nitrogen-ion bombardments of indium in the
60-inch cyclotron, by the reaction $In^{115}(N, 3n)$. Studies have
been made of this new chain with a 50-channel scintillation
spectrometer, a scintillation coincidence spectrometer, and
a time-of-flight mass spectrograph. Element assignments
and genetic relations have been verified chemically, and the
mass number assigned with the isotope separator. Ba^{126} de-
cays principally by orbital electron capture with a half life
of 96.5 ± 2.0 minutes, and its daughter Cs^{126} is a positron
emitter of 1.6 ± 0.2 minute half life and electron capture
branching of 18 ± 4 percent. The decay of Cs^{126} proceeds by
allowed transitions, ~ 62 percent to the ground state of Xe^{126}
and ~ 38 percent to the first excited state at 385 kev. The
positron spectrum has a maximum energy of 3.8 ± 0.4 Mev.
On the basis of its decay properties, Cs^{126} appears to have a
ground-state configuration of (1+). (auth)

804

A SEARCH FOR NATURAL RADIOACTIVITY IN NEODYMI-
UM, RHENIUM, AND OSMIUM. D. Dixon and A. McNair
(Univ. of Glasgow, Scotland). Phil. Mag. (7) 45, 1099-1108
(1954) Nov.

The element neodymium and the naturally occurring
isobaric pair Re^{187} and Os^{187} are investigated, as internally
mounted sources in a well-shielded proportional counter,
for evidence of natural radioactivity. The β-decay proba-
bility of Nd^{150} corresponds to a half life of not less than 10^{16}
yr. No beta instability of rhenium is observed, and 10^{15}
yr is suggested as the minimum possible half life for the
isotope Re^{187}. The emission of L x rays from osmium is ob-
served, but it is found that dense materials show similar
emission, and it is attributed to the photoelectric absorption
of γ rays (residual background) in the materials. It is con-
cluded that there is no evidence of decay in osmium and the
estimated minimum possible half life by electron capture
exceeds 10^{15} yr. (auth)

805

TABLE OF TOTAL BETA-DISINTEGRATION ENERGIES.
R. W. King (National Research Council, Washington, D. C.).
Revs. Mod. Phys. 26, 327-401(1954) Oct.

In order to make the information on β decay readily avail-
able for the study of mass differences, the total disintegra-
tion energies of all reasonably well-established decays have
been compiled and tabulated. The primary purpose of this
table is to offer "best" values of mass differences as de-
termined from β-decay data. It is envisaged that the values
in this compilation will be used in conjunction with reaction
data, as these become available, for a better evaluation of
mass differences. (auth)

806

TABLE OF ALPHA-DISINTEGRATION ENERGIES OF THE
HEAVY ELEMENTS. Frank Asaro and I. Perlman (Univ.
of California, Berkeley). Revs. Mod. Phys. 26, 456-62(1954)
Oct.

This compilation is a listing of total alpha-decay energies
with some supporting information pertinent to the means by
which the energies were derived. The decay energies are
the Q values for the alpha transitions and can be transformed
into mass differences by including the atomic mass of He^4.
(auth)

807

STUDY OF THE γ RADIATION EMITTED BY DIFFERENT
SOURCES OF P^{32}. M. Langevin and T. Yuasa (Collège de
France, Paris) and J. Merinis (C. N. R. S., Ivry, France).
J. phys. radium 15, 778-9(1954) Nov. (In French)

The internal bremsstrahlung of P^{32} was studied. Two
weak γ rays superposed on the bremsstrahlung spectrum
were observed at 720 kev and 1.2 Mev. The 1.2-Mev ray
was too weak to study. The 720-kev ray has a period of ap-
proximately 25 days. A source of P^{32} prepared by the P^{31}
$(n,\gamma)P^{32}$ reaction showed a 565 ± 10 kev γ ray. This ray was
attributed to As^{76} present as an impurity in the P. (J.S.R.)

808

CONTRIBUTION TO THE STUDY OF ACTIVE DEPOSITS
WITH RAPID EVOLUTION. M. Ader (Collège de France,
Paris). J. phys. radium 15, 782-3(1954) Nov. (In French)

The path lengths of the radiation from the decay products
(Po^{215}, Be^{211}, and Po^{211}) of Rn^{219} were studied. For each
element a path of great length, approximately 250μ, analo-
gous to those emitted by Po and Th, was found. (J.S.R.)

809

ABSORPTION MEASUREMENTS ON SECONDARY ELEC-
TRONS FOR THE ENERGY DETERMINATION OF γ RAYS.
G. Backenstoss and W. Gentner (Universität Freiburg i. Br.,
Germany). Z. Naturforsch. 9a, 882-6(1954) Oct. (In
German)

The energy determination of electrons from absorption
measurements by the Bothe coincidence method was used
for measuring γ-ray energies. By means of an additional
anticoincidence counter the geometrical relations could be
defined so well that the separation of both γ lines of Co^{60}
was possible. Measurements were made on Zn^{65}, Co^{60}, Ra,
and Th^{228}. (tr-auth)

SHIELDING

810

MOBILE SHIELD FOR CYCLOTRON TARGET REMOVAL.
R. A. Blomgren and N. J. G. Bohlin (Argonne National Lab.,
Lemont, Ill.). Nucleonics 12, No. 11, 62-3(1954) Nov.

SPECTROSCOPY

811

MICROWAVE SPECTRA OF THE ALKALI HALIDES.
A. Honig, M. Mandel, M. L. Stitch, and C. H. Townes
(Columbia Univ., New York). Phys. Rev. 96, 629-42(1954)
Nov. 1.

Data from the microwave spectra of all alkali halides
excepting LiF, NaF, KF, RbF, and LiCl are given and ana-
lyzed in terms of molecular and nuclear constants. These
yield internuclear distances and ionic radii for the gaseous
alkali halides, molecular dipole moments, potential con-
stants for some molecules, amount of covalent character
from quadrupole coupling constants and from rotational ef-
fects, and mass ratios for isotopes of Li, K, Rb, Cl, and Br.
(auth)

THEORETICAL PHYSICS

812

Chalk River Project (Canada)
STATISTICAL FACTORS FOR ELECTROMAGNETIC
TRANSITIONS. J. M. Kennedy and W. T. Sharp. Oct.
1954. 30p. (CRT-580; AECL-139)

Using the algebra of tensor operators, expressions are
obtained for the statistical factors for electromagnetic
transitions of arbitrary multipolarity between one and two
particle states. The modifications necessary if particles
are replaced by holes or if motion of the core is taken into
account are discussed briefly. (auth)

813

AGE-DEPENDENT BRANCHING STOCHASTIC PROCESSES
IN CASCADE THEORY. A. T. Bharucha-Reid (Columbia
Univ., New York). Phys. Rev. 96, 751-3(1954) Nov. 1.

A brief introduction to the recent Bellman-Harris theory
of branching stochastic processes is given in the nomen-
clature of cascade theory; and a simple model in cascade
theory formulated as an age-dependent branching process is
given. (auth)

814

MESONIC CORRECTIONS TO THE QUADRUPOLE MOMENT
OF THE DEUTERON. A. M. Sessler (Cornell Univ., Ithaca,
N. Y.). Phys. Rev. 96, 793-6(1954) Nov. 1.

Mesonic corrections to the quadrupole moment of the deu-
teron are calculated by means of the method of Tamm and
Dancoff. Only the two-nucleon and two-nucleon—one-meson
amplitudes are included. The first is associated with a
phenomenological wave function for the deuteron, the second

yielding a correction to the quadrupole moment. A correc-
tion exists even in neutral scalar theory, and for pseudo-
scalar (pseudoscalar) symmetry theory the result in adia-
batic approximation to second order is $\Delta Q = 3.1$ percent or
$\Delta Q = -0.7$ percent, depending on choice of wave functions
(assuming $g^2/4\pi = 10$). Contributions from multiple meson
amplitudes are examined, and for a hard-core deuteron
function they are shown to contribute only slightly. (auth)

815

TENSOR FORCES DEPENDENT ON VELOCITY. Marcos
Moshinsky (Institut Henri Poincaré, Paris). J. phys.
radium 15, 725-32(1954) Nov. (In French)

The tensor force recently introduced depends only on the
coördinates of the positions relative to two nucleons. It is,
however, possible to introduce a tensor force dependent on
the quantity of relative motion, which is here called the ten-
sor force dependent on velocity, and which, for the two-
nucleon problem, gives the same mixture of ^3S and ^3D
states as the ordinary tensor force. It is shown in a partic-
ular case that the tensor forces dependent on velocity lead
to motion equations which are mathematically identical to
elasticity equations. These tensor forces, therefore,
furnish a solution to two-nucleon problems by means of
known functions and give new forms of interaction which
are mathematically simple. (tr-auth)

816

ON THE THEORY OF COLLIDING PARTICLES WITH AS-
SIGNED ANGULAR MOMENTS. V. T. Khozyainob. Zhur.
Eksptl'. i Teoret. Fiz. 27, 275-82(1954) Sept. (In Russian)

Relativistic wave functions of a system of two fermions,
having reciprocal angular moments, were obtained by means
of spherical vector functions and represented in the form of
superposition wave functions of the plane wave type (with
spin). A detailed investigation gives a method of investiga-
tion of different processes by assignment of the moment of
momentum. (tr-auth)

URANIUM AND URANIUM COMPOUNDS

817

Argonne National Lab.
U^{235} THERMAL NEUTRON FISSION YIELDS AT MASSES
90 AND 91. George W. Reed. Mar. 1954. 10p. Contract
W-31-109-eng-38. (ANL-5306)

Thermal neutron fission yields in U^{235} were determined
for Sr^{90} and for Y^{91}. Upper limits were set for the inde-
pendent formation of Y^{90} and Y^{91}. (auth)